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Publishers' Note.—Beginning with the March, 1916, number of the CLINICS, we shall publish the Clinics of Dr. James T. Case (Battle Creek), Professor of Röntgenology at Northwestern University Medical School, and Röntgenologist to St. Luke's Hospital, Chicago. These clinics will have special reference to *x*-ray diagnostics in internal medicine, and will be profusely illustrated. These clinics, which are held in St. Luke's Hospital, will be published regularly in the MEDICAL CLINICS OF CHICAGO.

The
Medical Clinics of Chicago

VOLUME 1 NUMBER 4

CLINIC OF DR. FREDERICK TICE

COOK COUNTY HOSPITAL

EPIDEMIC CEREBROSPINAL MENINGITIS

Detailed Technic of Lumbar Puncture and Examination of Cerebrospinal Fluid. Description of Various Tests. Treatment with Flexner's Serum Will Save Not Less than 80 Per Cent. of Cases Under Proper Conditions. The Diplococcus of Weichselbaum Found in the Nasal Secretions of Carriers.

AT the last clinic we presented a patient on whom we made a clinical diagnosis of epidemic cerebrospinal meningitis. Briefly, the history consisted of the following: She was seventeen years of age, a stenographer by occupation, and entered the hospital nine days ago, Saturday the 2d of October at 5 : 45 P. M. She was admitted in a semicomatose, rigid condition with the history of having been sick for three days. From the patient, and also from the relatives, it would appear that she had been perfectly well up to the previous Wednesday, when she was seized with a severe headache and pains in the back of her neck with stiffness and rigidity of the spine.

Her past illnesses consist of the diseases of childhood, and there is also the history of a probable tuberculosis. The parents stated that the patient was quite healthy previous to the present illness.

We will not go into the physical findings except to mention the rigidity, with a very positive and definite Kernig sign and an absent Babinski. The pupils were equal and responded quite promptly to light.

Diagnosis.—The diagnosis of a clinical meningitis is not, we would say, particularly difficult, but it is far more difficult to

diagnose the specific type of meningitis. In this connection, the lumbar puncture is of the greatest assistance, and we probably can spend a little time to advantage this morning in a consideration of lumbar puncture, not only from the standpoint of its diagnostic assistance, but also as a means of treatment and its therapeutic effect.

Method of Performing Lumbar Puncture.—The position of the patient is somewhat a matter of choice; some clinicians prefer to place the patient in an upright position, or, in infants, to let the nurse hold the patient over her shoulders. A better position is obtained by placing the patient on one side in bed or on an examining table, with the limbs and neck well flexed.

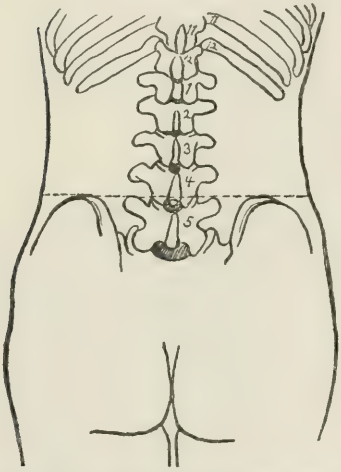


Fig. 107.—Diagram with landmarks for lumbar puncture.

As to the point or location of the puncture: It is necessary to make the puncture at a point where there is little or no danger of injury to the spinal cord. In children up to the age of one year the spinal cord extends down to slightly below the third lumbar vertebra. In adults the spinal cord terminates practically at the first lumbar vertebra. It is, therefore, necessary that we make our puncture below this point. The site of election is generally the fourth lumbar interspace, which is at the level of an imaginary line connecting the iliac crests.

With the patient either in the upright or the recumbent position, and with our landmarks fixed, the needle is introduced approximately at the intersection of the spine and this imaginary line.

One of two ways may be selected as the method for introducing or inserting the needle. Some prefer to make the puncture between the spinous processes, through the ligaments, which can

easily be done in infants and children, and usually also in adults. Perhaps an easier method, particularly in adults, is to introduce

Fig. 108.—Clinical landmarks for making lumbar puncture.

the needle a little to one side of the spinous process, half or three-quarters of an inch, and then direct the needle upward

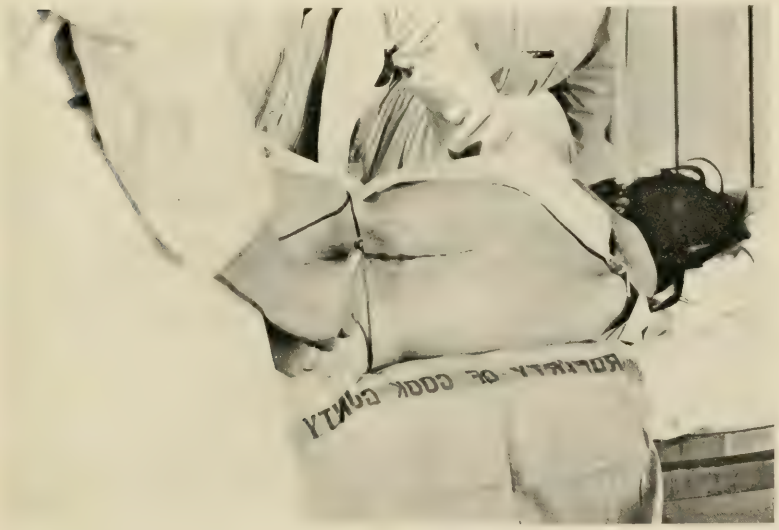


Fig. 109.—Needle inserted at intersection of line marking spinous processes and line connecting iliac crests, for the purpose of drawing off the spinal fluid.

and inward. It usually slips into the subarachnoid space without much difficulty.

Dangers of Lumbar Puncture.—There is relatively little danger, bearing in mind that the usual antiseptic precautions must be taken. The usual method of applying iodin to the site of the puncture is employed. All instruments and the hands of the operator must be surgically clean. No general or local anesthetic is necessary. Occasionally in introducing the needle a large vein may be punctured or injury done to one of the vertebral plexuses. Occasionally injury or serious danger may develop if the cerebrospinal fluid is removed too rapidly or in too large an amount, or, if certain pathologic conditions exist, such as cerebral tumors, which may herniate and produce sudden death.

To avoid the possibility of removing the fluid too rapidly (if the flow is evidently under pressure), one may interrupt the stream by inserting the stylet or by pressing the finger over the end of the needle. If a cerebral tumor is probable, before removing much fluid, Koenig's instrument should be employed. The measuring tube of this instrument has a small caliber, so it requires but a few drops to fill it. If no oscillation occurs in the fluid there is compression at the base of the brain. Removal of fluid under such conditions is dangerous.

Rate of Flow of the Cerebrospinal Fluid.—Under normal conditions it is at the rate of forty-five to fifty drops a minute. It must be understood that the flow will vary in accordance with the caliber of the needle used, but with the ordinary needle forty-five to fifty drops is normal. Under abnormal conditions the fluid may escape in a continuous stream, and under such conditions it is best to interfere with the flow. Occasionally a "dry puncture" is obtained; that is, no fluid is withdrawn. Where the needle is in the subarachnoid space and no fluid is secured the flow may be started by placing the patient in an upright position, if in the recumbent position at the time of the puncture; or, so-called elastic pressure may be employed by increasing the flexion of the limbs and the neck. Sometimes the flow may be increased by compressing the abdomen or by making the patient cry, cough, or take a deep breath, which is known as vascular pressure. If, in spite of these methods, no

flow results, then it is advisable to insert a second needle into the next space above the one where the puncture was made and to introduce sterile normal salt solution through the upper needle; if salt solution escapes from the lower needle then we may say we have a negative puncture. Not until this is done should we designate failure to obtain fluid as a "dry puncture."

Diagnostic Worth or Service of the Lumbar Puncture.—We can make a fairly accurate diagnosis of a meningitis from our clinical symptoms and signs, but it is only upon the laboratory findings, after a spinal puncture, that we can make a really definite diagnosis of the nature of the meningitis.

Perhaps it is well for us to consider the examination of the cerebrospinal fluid in a rather systematic manner.

Character of the fluid—whether it is clear, cloudy, hemorrhagic or chylous. The normal fluid is perfectly clear, almost identical with distilled water. This may be the case even under abnormal conditions in various types of meningitis, and even where organisms are present the fluid may apparently be normal.

The hemorrhagic fluid, as obtained in the lumbar puncture, is most frequently encountered in cerebral or spinal hemorrhages, due either to cerebral hemorrhage or apoplexy, or to traumatic lesions of the spine. Quite frequently the fluid is definitely bloody, due to traumatism or injury of the vessels by the needle. This, of course, is not to be considered as indicative of some abnormal condition which would lead to an error in diagnosis.

Specific Gravity of Cerebrospinal Fluid.—This is variable, but has little or no clinical value, for the reason that the cellular content is so variable that it bears no practical relation to any given condition.

The reaction is decidedly alkaline.

In the further examination of the cerebrospinal fluid one of the findings, from the laboratory standpoint, is the determination of the presence of an increased amount of a rather complex protein substance designated as globulin. Probably of the laboratory methods for examination of the spinal fluid, everything considered, the examination of the globulin is the most im-

portant. You must remember that globulin is normally found in the cerebrospinal fluid, but only in a small amount; in any condition resulting in a toxic or inflammatory change in the meninges there is produced an excess of globulin, and so it is very important to determine the increase in this substance, which may be accomplished by one of several methods.

Probably the method in most general use is that advocated by Nonne or a modification of Nonne's method. The Nonne and the Ross-Jones tests were both positive in this particular patient.

Nonne Test.—Phase I.—A saturated solution of ammonium sulphate is prepared by heating, then allowed to cool and mixed with an equal quantity of cerebrospinal fluid, $\frac{1}{2}$ or 1 c.c. of each is sufficient. Within the course of three minutes, if the globulin is increased, a very definite cloudiness appears. This constitutes a positive reaction.

Phase II.—The mixture is filtered; one drop of acetic acid added to the filtrate and boiled. The presence of a precipitate indicated albumins. This occurs in normal fluids.

The second method, the so-called *Ross-Jones method* or test, is practically identical with the Nonne, with the exception that the solution of ammonium sulphate is allowed to float upon the surface of the cerebrospinal fluid; they are not shaken or mixed, and in the same length of time, three minutes, at the point of contact a definite ring is formed.

The third method most frequently employed is the *butyric acid reaction of Noguchi.* This consists in adding to 0.1 c.c. of cerebrospinal fluid 0.5 c.c. of 10 per cent. butyric acid in physiologic salt solution. This is boiled, and there is added a quantity of normal sodium hydrate solution equal to the amount of the cerebrospinal fluid, and it is again boiled. A positive reaction is indicated by the formation of a granular flocculent precipitate which collects at the bottom of the tube. These methods indicate the presence and the abnormal increase of globulin. You must not infer that they have any particular significance as to the type of meningitis present. Further than this, the Nonne or the Ross-Jones or the Noguchi test has no sig-

nificance as to the quantity of globulin increase. If a quantitative test is desired another method must be employed, and for this purpose Kaplin's method is most frequently used.

Cytologic Examination.—Next in importance is the cytodiagnosis, or the determination of the cellular content of the fluid. Under normal conditions no cells at all may be present in the cerebrospinal fluid, but under abnormal conditions the cells may be very materially increased, which has a very definite bearing on the question of diagnosis. Various methods are employed in the determination of the number of cells, and of these the following may be mentioned.

The *Widal* and *Rivoult methods*, often referred to as the centrifuge method. Five c.c. of the fluid are centrifuged for twenty minutes, and a drop is removed and placed upon a slide in the same manner as that used in obtaining a blood smear.

The *Fuchs-Rosenthal method*, or counting chamber method. With a white cell pipet a dilution is made of the cerebrospinal fluid, and on the blood-counting chamber a determination of the number of cells is made exactly the same as in making a white blood count. This method is usually modified by adding a stain to the diluting solution (most frequently methylene-blue is employed) so that the cells are stained at the time of dilution and a direct differential count is then possible.

The Alzheimer Method.—This consists in taking 10 to 15 c.c. of 96 per cent. alcohol and 5 c.c. of cerebrospinal fluid; they are mixed in a centrifuge tube which is closed, preferably by a rubber stopper, and then centrifuged for forty to forty-five minutes. A definite coagulum occurs in various types of meningitis, cerebrospinal lues and paresis, but only a very slight formation occurs in normal fluid. The fluid is poured off and the coagulum fixed with alcohol, ether and alcohol and ether. The coagulum is then removed from the tube, embedded in celloidin, sectioned and stained in the same manner as ordinary tissue.

Number of Cells.—The normal number of cells in cerebrospinal fluid varies from 0 to 8 per c.mm.; from 8 to 15 per c.mm. is on the borderline, and anything above 15 is considered abnormal.

In many cases the count varies from 200 to several thousand. In this patient the first determination made, on the day she entered the hospital, was 14,000 to the c.mm. On the following day the number went up to 27,000; on Monday, the day she was presented in the clinic, the count was 22,000.

Serology.—Further examination of the cerebrospinal fluid, which is made possible by the lumbar puncture, consists in employing the serum for a Wassermann test. This, as you know, has assumed a considerable amount of importance during the past few years, and has revealed the fact that the blood-serum Wassermann and the spinal fluid Wassermann do not always, by any means, run parallel. We may have, as is frequently the case in cerebrospinal lues, a positive blood-serum Wassermann while the spinal fluid is negative. On the other hand, paresis or tabes is very frequently associated with a negative blood-serum Wassermann while the spinal fluid is positive.

Examination of the cerebrospinal fluid by means of Lange's colloidal gold chlorid method is of great assistance, and, according to reports, it would seem that it is even more reliable and of greater assistance in the determination of the presence or absence of luetic infection than the Wassermann, and by this method it is possible to make a fairly definite diagnosis of the particular type of luetic infection.

Bacteriologic Examination.—Then, still further, the examination of the cerebrospinal fluid is of particular service in the determination of the presence or absence and variety of the infection. This may be done by direct examination; that is, by smears and staining; by culturing; or, still further, by inoculations.

In certain diseases the bacteriologic examination of the cerebrospinal fluid may be apparently of little service. This is particularly true of tubercular meningitis, for it is difficult to demonstrate the tubercle bacillus in the cerebrospinal fluid. The method usually employed for this purpose is to permit the fluid to stand in a small test-tube, or some convenient container, and after a very short time a definite pellicle will form on the surface of the fluid. This may perhaps be best removed by floating it

on to a cover-glass or a slide; then fix and stain in the usual method for tubercle bacilli. The bacilli are not infrequently found in this network of fibrin, and it makes a very easy method of detection. More frequently, it is possible to demonstrate the bacilli by this method than by centrifuging.

Another method of considerable assistance is to place a cover-glass in the bottom of the vessel containing the cerebrospinal fluid, and after a few hours there is a gradual precipitation of

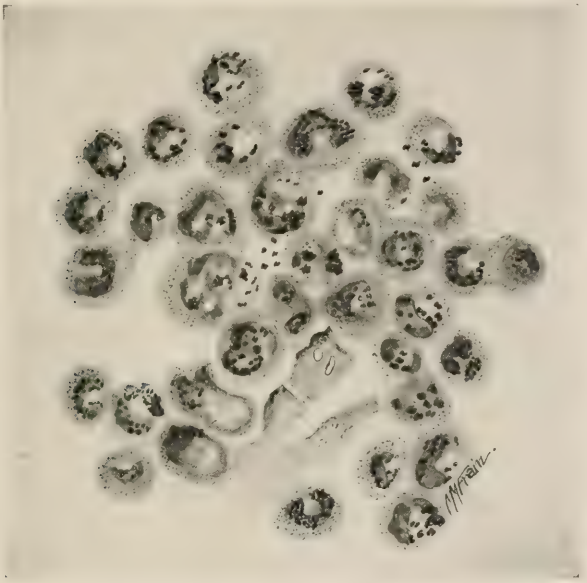


Fig. 110.—Smear of cerebrospinal fluid with Diplococcus intracellularis meningitidis.

the cells and bacilli in the fluid; the cover-glass is then removed, allowed to dry in the open air, fixed and stained. Some prefer this method. The one most generally in use in this hospital is the first method.

The determination of other bacteria, and particularly the specific organism in the production of epidemic cerebrospinal meningitis, is usually not so difficult. This is done by placing a small amount of the fluid upon a microscope slide and allowing it to dry, then fixing and staining with one of the ordinary dyes.

A more definite means of identifying the bacteria is to employ the Gram method, as that enables us almost immediately to tell which group is present. The gonococcus is occasionally found, but very rarely, and the staphylococcus is a rare invader.

Therapeusis.—Lumbar puncture may be done with the object of decreasing intracerebral pressure. In cases of chronic interstitial nephritis with increased blood-pressure, in cerebral tumors

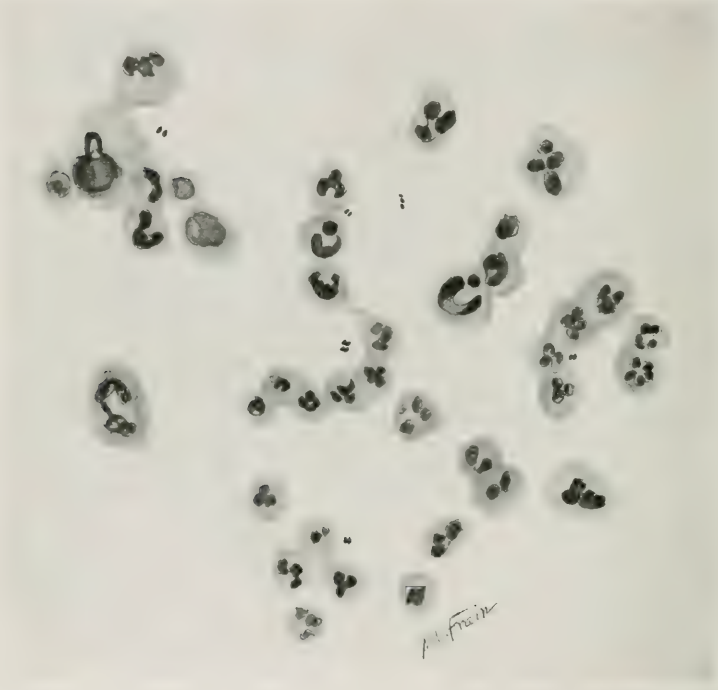


Fig. 111.—Smear of cerebrospinal fluid with Streptococcus viridans.

associated with increased pressure, in hydrocephalus, or other conditions requiring a decrease in the intracranial pressure we can as effectually accomplish it by this method as by a decompression operation. A procedure not uncommon in the treatment of uremic convulsions is to perform a lumbar puncture. The increased pressure in delirium tremens is best controlled by puncture and with the most gratifying results. Lumbar puncture has also been employed in producing spinal anesthesia.

Further therapeutic service consists in the introduction of various serums, such as antitetanic and Flexner's, into the subarachnoid space through the spinal puncture needle. Recently the intraspinous administration of neosalvarsan and salvarsanized serum has gained considerable prominence. The introduction of antitetanic serum, Flexner's serum, and various other serums is a frequent procedure.

This patient on Saturday afternoon, the day she entered the hospital, received 30 c.c. of Flexner's serum; at seven P. M. she received 30 c.c. more. On Sunday an additional 30 c.c. was given, and on Monday a fourth injection of 30 c.c. In the administration of the serums, or neosalvarsan, or whatever substance is employed, it is customary to remove an amount of cerebrospinal fluid equivalent to the amount of fluid that is to be injected. It is of considerable importance that the fluids be introduced slowly. This may be accomplished by the gravity or syringe method, using gentle, gradual pressure. An ordinary syringe or, better, a Luer type of syringe may be used. Where pressure is employed a considerable amount of care should be exercised. If the fluid is introduced too quickly dangerous manifestations are likely to appear.

Now a word or two in reference to the *mode of infection* in epidemic cerebrospinal meningitis. The specific organism is the *Diplococcus intracellularis meningitidis* of Weichselbaum. The question of clinical interest is how the organism gains entrance to the system and how it reaches the meninges. It has been determined by the work of Albrecht and Ghon that a nasal infection, particularly an infection of the upper respiratory tract, is very common. The patients do not necessarily present a coryza or a bronchitis, but most of them will show an inflammation of the nose and upper respiratory tract. The demonstration of the organism in the nasal secretion depends very materially upon the time of the examination, and also whether the examination is made immediately upon obtaining the secretion. Usually after the lapse of three or four days the number of organisms materially decreases so that in a very short time, in the course of two or three weeks, they are no longer pres-

ent, and this may be the case even where the manifestations of meningitis still persist.

It is of considerable importance to know that experimentally it has not been possible to produce a cerebrospinal meningitis by infecting the nasal cavities. The question then is, What significance are we to place upon the presence of the organisms in the nasal secretions? In epidemics, and particularly during the last few years, the systematic examination of the nasal secretions has revealed the fact that 65 to 80 per cent. of the individuals coming in contact with cases of epidemic cerebrospinal meningitis contain the organism in their nasal secretions. In other words, they are carriers. Only a small percentage of these carriers actually develop the disease, but they act as distributors of the disease, and from them susceptible individuals are actually infected.

So far as can be determined, the meningeal infection probably occurs through the blood; 30 to 40 per cent. of the clinical cases of epidemic meningitis will give a positive blood-culture. When the methods of examination are perfected it may be possible to demonstrate a higher percentage of positive blood-cultures. The bacteria are carried to the meninges in the blood, and there produce the clinical manifestations of the disease.

In the experimental work it has not been possible to produce a meningitis by nasal sprays, by subcutaneous or intravenous injections. It is necessary to make a direct infection of the meninges. When the basal meninges become involved, in the course of two, three, or four days, the organism appears in the nasal secretion. Whether this is a means of elimination or not is not definitely known.

Treatment.—Epidemic cerebrospinal meningitis is only mildly infectious. In the hospital these cases are segregated; they are invariably placed in a room removed from the others, and all of the usual precautions are taken to prevent the distribution of the infection in the care of the bed linen, the clothing, the dishes and various utensils, and particularly in the care of the sputum and nasal secretions.

The infection spreads by means of droplets of mucus or spu-

tum, and it is in this way that the actual distribution takes place.

The active treatment consists in the administration of Flexner's serum. This is administered intraspinally; it has little or no effect whatever when given subcutaneously or intravenously; it must be given intraspinally. In a case of ordinary severity it is usually considered satisfactory to give 30 c.c. of the serum every twenty-four hours for four successive days. Then a period of two, three, or four days is allowed, and if the symptoms return—the rigidity or temperature, or if on lumbar puncture there is an increase in the cellular content of the fluid—a second course of three or four injections should be employed.

If the case is particularly severe, one of the fulminating type, then it is best to give two injections in the first twenty-four hours. The action of the serum depends upon various immune substances, chiefly bacteriolysins, bacteriotropins, and anti-endotoxins.

The patient presented a week ago, as you will recall, entered the hospital on the previous Saturday. At that time she had a temperature of 100° F. per rectum, pulse 100, respirations 32. On Sunday the temperature did not exceed 98.4° F. per rectum, the pulse did not exceed 86, and the respirations had fallen to 20. On Monday the temperature, when in the clinic, was 102° F., pulse 122, respirations 26. That afternoon the temperature reached 102.4° F., pulse and respirations remaining the same, and on the following day in the morning the temperature was 101° F. and in the afternoon 102.4° F. On the 5th, in the morning at six o'clock, the temperature was 104.6° F., pulse 150, respirations 62, and in the afternoon the temperature reached 104.8° F., the pulse became imperceptible, the respirations reached 62, and the patient became more and more stuporous, with a fatal termination.

As was indicated at the time, the prognosis was unfavorable. This was based partly on the fact that she had already received two injections of the serum, and the usual beneficial effect had not been observed on the cerebrospinal fluid. The cellular count on the first examination was 14,000; this was increased to 27,000,

and then fell to 22,000. Ordinarily, there is a very prompt response to the serum; the cellular content and number of bacteria diminish and their staining properties are lessened.

The diagnosis in this case was that of a meningitis; specifically, an epidemic cerebrospinal meningitis, without any complications. The administration of Flexner's serum was relatively early, but unfortunately the case had an unfavorable termination. The usual results, as obtained by Flexner's serum, an illustration that holds good practically in the majority of the epidemics, is that of the experience in Akron, Ohio, where a considerable epidemic prevailed a few years ago, and where in the untreated cases 87 per cent. died. In those treated with Flexner's serum 72 per cent. recovered. We may safely say that with Flexner's serum, properly administered, depending upon the length of the disease and the presence or absence of complications, we may look for a favorable outcome in not less than 80 to 90 or 95 per cent. of the cases.

A CASE OF BILATERAL TUBERCULOSIS ASSOCIATED WITH PICK'S CIRRHOSIS. PARACENTESIS ABDOMINALIS AND INTERPRETATION OF ASCITES

DR. TICE: What is the diagnosis?

VISITOR: A bilateral tuberculosis.

DR. TICE: Why do you say a "bilateral tuberculosis"?

VISITOR: The upper lobe of the right lung is affected and the entire left lobe shows the same condition.

DR. TICE: A bilateral pulmonary tuberculosis; have you any absolute proof of pulmonary tuberculosis?

VISITOR: I don't know the results of any of the laboratory examinations.

DR. TICE: What did you find?

SECOND VISITOR: A primary bilateral tuberculosis, with possibly an involvement of the liver.

DR. TICE: Did you learn that there had been an ascites?

VISITOR: Yes.

DR. TICE: *Present History.*—This patient is forty-three years old. She entered the hospital on the 9th of September. The symptoms, as related at that time, consisted of the following: An extreme shortness of breath, a distention of the abdomen, and great swelling of her feet; also a diarrhea. The patient was taken sick three years ago with pains in her chest, a cough and some shortness of breath. Physicians told her at that time that she had tuberculosis of her left lung. The cough was productive, but she never expectorated blood; she lost some weight, but had a fair appetite. About a year ago she developed a diarrhea, which has continued up to the present time. Her bowels have moved ten or more times a day. Five months ago she was sent to a fresh air hospital where she remained for five weeks, here she first noticed the development of the dropsy. About this time the cough disappeared for about two weeks; later the cough reappeared, associated with a dizziness, with some disturbance of her vision and for a short time on one occasion there was trouble with her speech.

Personal History.—Patient never married; her father died when she was two years old from acute pulmonary tuberculosis; the mother died twenty years ago from a sarcoma. One sister is sick at the present time with some abdominal involvement. The patient has never used whisky, beer only in limited amounts. Venereal history is negative.

When she entered the hospital her temperature was 99.8° F., pulse 100, respirations 30. The day following the temperature was normal, and has remained constantly below 100° F., never exceeding this point, and the slight rise occurs in the afternoon, at the four or eight o'clock period.

When this patient entered the hospital the abdomen was considerably distended, the limbs were swollen and edematous, and she was compelled to assume an upright position because of the dyspnea. On the same day she entered a paracentesis of the abdomen was done and 5000 c.c. of fluid removed; which gave a specific gravity of 1012. It was rather definitely blood tinged. The cells consisted almost entirely of lymphocytes. Ten days later a second puncture was made, and at that time 800 c.c. were removed with a specific gravity of 1010, and the differential

showed 2 per cent. polymorphonuclears and 98 per cent. lymphocytes. There were 300 cells to the c.mm.

At the present time you can all observe the difference on the two sides of the chest with the patient in the dorsal position. There is very distinct retraction of the entire left side, a greater prominence on the right, with marked difference in the degree of expansion. With a slightly forced breath you can observe that the left side remains practically stationary.

The apex-beat is in the fifth intercostal space, just outside the nipple line. Further inspection of the chest reveals the presence on the right side of a definite diaphragm shadow or Litten sign, which indicates that the right pleura is free. On the left side you will observe that there is an inspiratory retraction of the intercostal spaces.

We have already located the apex-beat in the fifth intercostal space, and, on closer examination of the apex-beat, there is found a systolic retraction or a systolic depression,—a drawing in at the point of the apex instead of a bulging.

On percussion over the left lung anteriorly, there is impaired resonance, practically a flatness of the entire side. Only in one location, just below the clavicle in the midclavicular line, is there a slight hyperresonance. On the right side there is relative dulness over the apex, the remainder is hyperresonant.

The right border of the heart is at the left border of the sternum; the left border it is impossible to determine, for the cardiac dulness is continuous with the pulmonary dulness of the left side.

Over the entire left lung, on auscultation, the breath sounds are bronchovesicular, associated with loud, moist râles, except over the area of slight hyperresonance, where there is very definite amphoric breathing. Over the right side, above the clavicle, there is a slightly increased intensity of the breath sounds with an occasional râle; over the remainder of the side the sounds are normal.

Posteriorly the pulmonary findings are practically the same as those found anteriorly. On auscultation there is a faint systolic murmur at the apex, and over the base of the heart a very loud, ringing, accentuated second pulmonic sound.

On examination of the abdomen at this time we find a moderate distention, with no rigidity. The lower border of the liver is practically on a level with the umbilicus. The surface of the liver is not rough or nodular. Dulness is present in the flanks in the recumbent position, which shifts on change of posture. The limbs at this time are not swollen, but we can observe the evidences of previous distention. The skin is rather thick, and marked by scars from the overstretching. The reflexes are all negative.

The first examination of the sputum was negative; the second examination, by the antiformin method, revealed the presence of a large number of tubercle bacilli.

The diagnosis is definite and positive as to a pulmonary tuberculosis, affecting the entire left lung and with the presence of suggestive signs of a cavity in the upper lobe, and this is confirmed by the *x*-ray examination. According to the report from the *x*-ray department, from an examination made on the 14th of September, there is an extensive fibrous pulmonary tuberculosis with cavities. The retracted condition of the left chest, interference with the expansion, the absence of Litten's sign, absence of the respiratory excursion and the pulling of the heart over to the left, establishes the diagnosis of an adhesive pleurisy. On the right side, as you will recall, the Litten phenomenon is present.

As to the condition of the heart: a rather faint systolic murmur is present only at the apex, with a loud, accentuated second at the base. Of significance and importance is the systolic retraction at the apex.

This patient, when she entered the hospital, had an enormous ascites with edema, particularly of the lower extremities. There were two aspirations, one giving a specific gravity of 1012, the other of 1010, and without indicating any definite findings that would suggest a probable inflammatory involvement. With a definite pulmonary tuberculosis and ascites we would be justified in suspecting a tubercular peritonitis, but this fluid was not inflammatory in nature. What, then, produced the ascites? This patient does not admit the use of alcohol, except for an occasional glass of beer, and there is no history of a specific infection. A blood-serum Wassermann was negative. The indica-

tions are all definitely against a probable cirrhosis of the liver from the standpoint of the etiology. This is also true from the physical examination of the liver. Was this ascites and edema due to broken compensation of the heart?

The heart at the time she entered the hospital was compensated, but revealed the presence of a murmur at the apex, and certainly at this time we cannot diagnose an endocardial lesion.

What are some of the other possibilities? With the findings of a pulmonary tuberculosis and adhesive pleurisy and the development of ascites with enlargement of the liver, we should bear in mind one condition, and that is, a multiple serositis—the multiple infection of the pleura, pericardium, and peritoneum. That the left pleura is involved we can definitely demonstrate. As to the peritoneum, the fluid was not suggestive of an inflammatory involvement, and as to the pericardium, we have one somewhat suggestive finding in the presence of the systolic retraction. This requires, then, the serious consideration of the type of disease designated as a Pick's cirrhosis, or pericarditic pseudocirrhosis, which was first described by Pick in 1894. The pericardial sac is obliterated, which is associated with enlargement of the liver, and is characterized clinically by the development of ascites with little or no edema of the lower extremities. It is Pick's interpretation that the enlargement of the liver and the ascites is purely mechanical as the result of the adhesive obliterative pericarditis. Whether in some cases the peritoneal involvement is the result of infection is a question. This must undoubtedly occur in some cases.

A diagnosis has also been made of an intestinal and a renal tuberculosis. She has had repeated attacks of diarrhea, but there is no history of intestinal pain or colic, and the stool examinations have been negative. Repeated urinalysis has also been negative.

We can, however, make a diagnosis of pulmonary tuberculosis, bilateral, involving almost the entire left lung, with cavity formation, and slight involvement of the right apex; a complete obliteration of the left pleural cavity, and probably an oblitera-

tion of the pericardial sac; an enlarged liver with ascites. The entire clinical picture possibly justifies the diagnosis of a Pick's cirrhosis—a pericarditic pseudocirrhosis.

ACUTE ENDOCARDITIS WITH A COMPLICATING MENINGITIS

***Streptococcus Viridans* Obtained in Blood-cultures. Cerebrospinal Examinations. Determining the Atrium of Infection.**

Dr. Tice: This patient entered the hospital on the 14th of October. She is eighteen years old, and the following history was obtained:

Her present complaint consists of pains in the legs and arms, fever and sweats, headache, hunger and constipation. Two weeks ago the patient caught a cold, began to cough, and felt some pain which localized in the region of her heart. She stayed home from work, but did not go to bed. The pain in the heart disappeared four days ago. She grew weaker, however, and on the day before coming to the hospital was confined to her bed. She now complains of the pains in her legs and arms; the discomfort apparently is not limited to the joints. She has also felt feverish and chilly at times. There is no history of a definite chill, although she has had chilly sensations. She had a slight nosebleed a few days ago. According to the history, this is not uncommon, as she has had recurring attacks of nasal hemorrhage. Her appetite is good; in fact, she is constantly hungry. She has had no abdominal distress or discomfort.

Past History.—At the age of ten she caught a cold, had pains in her legs and arms, followed by a rather severe attack of sore throat, apparently a tonsillitis. She was confined to bed for two weeks. One year ago she had an attack which was identical with the former one, which confined her to bed for four weeks. She cannot recall that she has had any other diseases.

Family History.—The father and mother are dead, cause unknown. Three sisters are living and well. The patient is single,

the menstrual history is negative, and there is a negative history as to any specific infection. She has used beer in moderation for the last two years, whisky and wine occasionally.

When this patient entered the hospital four days ago, her temperature at 4 P. M. was 99.6° F., pulse 104, respirations 24. At 8 o'clock her temperature was 101.9° F., pulse 100, respirations 24. At midnight the temperature had reached 102° F. The following day at 4 A. M. the temperature was 101.8° F.; at 8 A. M., 100.6° F. At 4 P. M. the temperature was 104° F., pulse 114, and respirations 26. On the following morning the temperature was 103.6° F., in the afternoon, 101° F. On the morning of the seventeenth it was 101° F., and in the afternoon, 102° F.; this morning the temperature is 102° F.

The patient, as you can observe, is resting upon her side, and this is the position which she assumes when left to herself; it is possible, however, to place her in the dorsal position. In our physical examination, partly because of the previous history of a tonsillitis and apparently two attacks of articular rheumatism, we will direct our attention first to the heart.

Examination of the Heart.—On inspection we find the apex-beat in the fifth intercostal space, midway between the nipple and the anterior axillary lines. No abnormal pulsation in the upper portion of the chest or in the neck. On palpation, we confirm the location of the apex-beat in the fifth intercostal space, and also find the force of the beat as relatively strong, rhythm regular, but of greater importance is the presence of a thrill which occurs before the apex-beat—a presystolic thrill. There is no thrill over the base of the heart. On percussion, the right border is two fingers' breadth to the right of the sternum; the base is at the upper border of the second rib and the left border is only fairly well inside of the anterior axillary line.

On auscultation at the apex two tones are present, the first tone rather increased in intensity, accompanied by a systolic murmur, and preceding the first sound and the systolic murmur there is a definite presystolic murmur. In the midaxillary region the systolic murmur and the first sound are both audible, the presystolic has disappeared; the presystolic is heard only at

or near the apex. Over the third and fourth left interspaces the two tones are present with a loud systolic murmur. Over the pulmonary area a systolic murmur, not so intense as the one at the apex, followed by a loud accentuated second sound. Over the aortic and tricuspid areas can be heard a systolic murmur, softer than the one at the apex.

The pulse rate we have already noted. The rhythm is perfectly regular, the tension is not increased.

Examination of the lungs reveals practically nothing except a few scattered râles; no dulness, no bronchovesicular breathing.

Examination of the Abdomen.—Inspection is negative; palpation shows no rigidity. The liver and spleen are not palpable, nor does the splenic dulness extend below the costal border.

There is no enlargement of the cervical or axillary glands. The throat is injected, but there is no exudate of any kind. There is apparently an increase of the nasal secretion. With these findings, considering the history and the physical examination as far as we have gone, what might we conclude?

VISITOR: A rheumatism with an endocarditis.

DR. TICE: Yes; what kind of an endocarditis?

VISITOR: An acute endocarditis.

DR. TICE: As far as the interpretation of the lesion is concerned, we can say that this is a double mitral; we have the findings of an increased cardiac dulness with a presystolic thrill and a presystolic murmur at the apex. The murmurs which we hear over the different cardiac areas are all systolic in time, and, though of the same character, are much reduced in intensity. We would infer from this that the murmur heard over the aortic, the tricuspid, and the pulmonary areas are the same, transmitted from the mitral, and not indicating an involvement of the different orifices.

Now, as to whether this is a chronic or an acute endocarditis. The patient gives a history of two distinct attacks of rheumatism, but there is no history of a recent infection; no sore throat, no scarlet fever, no arthritis, nothing on which we might base a diagnosis of an acute endocarditis.

When this patient entered the hospital the urine was exam-

ined and found negative; since that time two subsequent examinations have been made, with normal findings. At the time of her entrance a blood examination was made and revealed 3,840,000 reds, 13,700 whites, a hemoglobin percentage of 58. In going over the patient in the routine physical examination it was observed that she presented some rigidity of her neck which has persisted to the present time. Examination of the eyes showed the right pupil to be considerably larger than the left; both pupils responded fairly well to light. At this time there is a slight ptosis on the left side.

Patellar and tendo achillis reflexes rather exaggerated. Very definite Kernig, but no Babinski.

With these findings, a lumbar puncture was made the day she entered and 20 c.c. of fluid was removed and found to be very cloudy. The cell count revealed 280 cells to the c.mm.; the differential showed 95 per cent. polymorphonuclears, 5 per cent. lymphocytes. In this fluid and within the cells fairly numerous diplococci were found which proved to be Gram negative. A second puncture was made on the 16th; 20 c.c. of fluid was removed, and this time the cell count was 2000 and in the stained smear a few organisms were present, all of which were extracellular, none intracellular. On the 17th a third puncture showed 350 cells to the c.mm., cocci in pairs and arranged in fours, practically all extracellular. After each spinal puncture, because of the presence of the Gram-negative organism, 20 c.c. of Flexner's serum was given. The lumbar puncture findings brought up some rather interesting considerations. From the history and physical examination, aside from the puncture findings, we might very justly conclude that this patient is suffering from an acute endocarditis. The presence of a heart lesion, the previous history of recurrent attacks of tonsillitis and articular rheumatism, the presence of a temperature and a moderate degree of leukocytosis, would justify the belief that an acute endocarditis existed. There are some negative findings, however, that are more or less suggestive, and those are the absence of an enlarged spleen and of embolic phenomena. The patient presents no evidence of an embolic process either internal

or cutaneous; consequently, the question remained open as to whether or not this was an acute endocarditis.

After the lumbar puncture the problem became more difficult because of the Gram-negative diplococci in the cerebrospinal fluid. The question then was, Is this heart lesion an old affair, due to the previous attacks of sore throat and rheumatism, and are the temperature and other manifestations at the present time due to an epidemic cerebrospinal meningitis? In order to arrive at a more definite conclusion blood-cultures were made by three independent workers. The blood was taken on Friday, with a report this morning that all three workers have arrived at the same conclusion; the blood-cultures are positive and show the presence of the *Streptococcus viridans*. Various cultures were made and they all show typical colonies. All of the three workers obtained the same organism in pure culture. This is highly important, for the reason that beyond any doubt it establishes the diagnosis of a systemic infection and possibly an acute endocarditis. From the first or second attack of her tonsillitis and rheumatism there was an endocardial involvement which produced a simple endocarditis, developing a chronic endocarditis, and recently, within the last few days or weeks, there has been a reinfection with the organism which usually produces the recurrent type of endocarditis, the *Streptococcus viridans*.

What is the relation of the meningitis to the acute endocarditis and systemic infection? The organism in the cerebrospinal fluid, according to the Gram method, was highly suggestive of the *Diplococcus intracellularis meningitidis* of Weichselbaum. The organism at the time of the first puncture being intracellular as well as extracellular led to the conclusion that it was not an accidental contamination. We are sure that the organism was in the cerebrospinal fluid.

As to the interpretation of the laboratory findings in the first cerebrospinal fluid: It is conceivable that the Gram stain was misleading; perhaps faulty staining solutions or questionable technic; or, as may occur with the *Streptococcus viridans*, some of the strains actually may be Gram negative. In order to

arrive at a more definite and absolute determination another puncture will be made, the fluid will be cultured, and the organism studied still further. To assist in the matter of the probable source of infection smears will be made from the nasal secretion and the throat, the urine will also be cultured. These findings will be reported at some future time.

On previous occasions, after each spinal puncture Flexner's serum was injected, but this puncture will be made exclusively for diagnosis; we wish to obtain some more of the fluid for further study. This fluid will be examined in the usual routine manner, but especially by culturing, that it may be definitely determined whether the organism is the *Streptococcus viridans* or the *diplococcus* of Weichselbaum.

As to the diagnosis, we can make a definite statement that this patient has an endocarditis, with the clinical signs of a double mitral, and, so far as we can determine, of the type due to the *Streptococcus viridans*. As not infrequently occurs, there is a complicating meningitis, and it is reasonable to conclude that the meningitis is due to the same organism. That a double infection might occur is possible. We know, from our clinical experience, that an acute endocarditis is frequently accompanied by a meningitis, and the ultimate conclusions will be determined by subsequent observations.

The prognosis is definitely unfavorable. Little or nothing will be accomplished by treatment. In similar cases various drugs, vaccines, or the intravenous use of collargol have produced no benefit. This patient will become worse and worse and go on to a fatal termination.

Subsequent History.—One week ago today we presented a patient with the clinical manifestations of acute endocarditis complicated by meningitis, on whom a lumbar puncture was made. The patient when presented had a temperature of 101° F.; that afternoon the temperature went up to 102° F. The following day, in the morning, it was 99.6° F., and that afternoon it reached nearly 103° F.; since that time the temperature has continued with a definite morning fall and after-

noon elevation. This morning her temperature is 101° F. Reference was made to the laboratory findings in reference to the cerebrospinal fluid. The fluid which was removed here in the clinic was taken to the laboratory for immediate examination, and showed a very definite increase in the pus cells and the presence of diplococci, which were Gram positive. The fluid was also cultured by two independent workers, and up to the present time both have reported negative results. Experimental animals were inoculated with this fluid and one of them died two days later; no endocardial involvement was found. Another of the animals was killed two days afterward and the endocardium was negative. We also referred to attempts at other cultures, but nothing has been obtained from them. One culture from the urine revealed a growth, but that was a contamination.

Her present condition is practically the same as it was a week ago. The cardiac findings are just about the same, her meningeal manifestations perhaps a little more pronounced. In addition to these, she has, during the last twelve hours, developed a very pronounced toxic dermatitis, a very profuse erythematous rash all over the body, with cutaneous hemorrhages in a few places. They apparently are not embolic, but appear more like hemorrhages which occur in a toxic dermatitis.

CLINIC OF DR. WALTER W. HAMBURGER

COOK COUNTY HOSPITAL

PRIMARY CARCINOMA OF THE LIVER

Diagnosis Masked by Symptoms Resembling Duodenal Ulcer and Chronic Indigestion. Suggestive Symptoms and Rarity of Primary Carcinoma of the Liver. Differential Diagnosis of Jaundice, Splenic Tumor, and Ascites in Various Types of Liver Enlargements. Postmortem Findings.

Discussion of the Pathology by Dr. Edwin G. Kirk, Pathologist to Michael Reese Hospital.

THIS patient is a laborer, forty-five years of age, who entered the hospital on the 20th of July, with the following complaints: Shortness of breath, particularly after exertion; general weakness; loss of weight (thirty pounds in the last nine months); constipation, sometimes with no bowel movement for six days; pain and swelling in the legs, more marked toward evening; cough, productive of a yellowish-white sputum; no hematemesis; and pain in the epigastrium. The latter symptom is not marked at present, but at times is pronounced, especially after a heavy meal of meats. He does not vomit except very occasionally, particularly if he smokes cigarettes before breakfast. He complains of a sense of fulness in the chest associated with the dyspnea, and this is really his most prominent symptom. He became ill nine months ago with a severe cough, spitting no blood, but raised the same yellowish-white sputum. He has lost greatly in weight, and has been unable to work on account of weakness and loss of weight.

Previous Illnesses.—He has been ill two or three times before this, but thinks those illnesses were of no special importance. Several years ago the right eye became swollen spontaneously, and shortly after that he had some indefinite involvement of the

right upper part of the body. Venereal disease is denied. Previous to nine months ago he drank considerable whisky, as much as a pint daily. He has been a laborer all his life, but has never worked in lead or brass. He is single.

Family History.—His father and mother died from unknown causes; one sister died of tuberculosis.

Examination on entrance showed that the pupils were normal and reacted promptly to light. His breath is foul. His throat is negative; no marked adenopathy; no enlargement of the thyroid. His chest shows marked flattening, with some retraction of the right apex; the excursion of the right side is greatly lessened; the resonance of both apices is somewhat diminished; numerous fine râles are heard over the right and left lower lobes. The heart shows some dulness to the left. In the abdomen an indefinite mass is palpable in the right upper quadrant; there is no distention of the stomach, the mass in the right hypogastrium being above the stomach. The spleen is not palpable. He has an epigastric hernia; there is also an inguinal hernia.

Patellar and pupillary reflexes are present and normal.

The blood shows a hemoglobin of 65 per cent., white count 3000, differential practically negative. The urine showed a specific gravity of 1034 and 1032 in two examinations; no albumin, no sugar. A Wassermann on the blood was negative. An Ewald test-meal showed 2 ounces of material, free acidity of 30, total of 60. Stomach contents analysis on several occasions showed practically the same findings. Several examinations of the stools were negative. He was fluoroscoped on the 31st, with a report as follows: "The stomach shows a moderate residue after seven hours; there is some residue in the terminal ileum. With the second meal the stomach fills normally, showing normal peristalsis. The duodenal cap did not show on vertical examination; on horizontal position the barium was seen in the upper part of the stomach. The *x*-ray plates did not show the duodenal cap, but showed no permanent defect of the stomach. There is evidently some tumor outside of the stomach, probably pressing on it from behind."

On the 3d of August examination of the sputum was negative for tubercle bacilli, but on the 8th large numbers were found. He was then referred to the *x*-ray department for special lung examination. "Both apices dull; the entire left lung dull. The left diaphragm does not move much; the left costophrenic angle is dull. The heart is enlarged and pulled to the right. The plates show a rather marked substernal dulness."

To summarize the findings in this case very briefly, they may be put down as follows: In view of the positive tubercle bacilli in the sputum, together with the dulness at the apices and fine crepitant râles, as well as the positive *x*-ray findings, we can safely say that this man is suffering with an advanced pulmonary tuberculosis.

The abdominal findings, particularly the indefinite firm mass in the right hypochondrium, indicate, in all probability, a disease of the liver. This mass is firm, descends upon inspiration, its surface is hard and irregular, and in view of the clinical history—particularly the marked loss in weight, anemia and weakness—is most likely a malignant process. Carcinoma of the liver in this case should be classified as either primary or secondary carcinoma, and must be differentiated from tertiary lues of the liver with multiple gummata or possibly Laennec's cirrhosis. In view of the history of his having drunk considerable whisky, it is very probable that he has an alcoholic cirrhosis. The stomach findings furnish no definite evidence of gastric cancer as the primary focus if this is a secondary cancer of the liver.

I am presenting this case to you very hurriedly, not because it is without interest and merits no more consideration, but simply so that you may palpate this firm tumor mass (which I take to be cancer of the liver), and, having the "feel" of this cancer in mind, to present to you another particularly interesting case this morning.

I have brought over the complete history, pathologic findings, and pathologic specimens of this case, which I wish you to see. The history concerns a man of forty-two years whom I first saw just one year ago. He was a builder by occupation, being in the

concrete manufacturing business. He came to me because of stomach distress and gave a history about as follows: As a preliminary statement he said that he had suffered from stomach distress since he was thirty (that is, for the past ten or twelve years), and that this distress consisted of a *fulness* and *pressure* after meals, increasing to some extent until the next meal. He went on to say that his whole family suffered from similar "indigestion," and in view of this long period of intermittent gastric distress he had paid little attention to the present attack. Then he told me that for six months or a year previously his concrete business had been very bad and he had worried considerably, adding that if the business did not pick up he would have to go out of business entirely. In telling me this his eyes filled with tears, and he apparently was very much upset and depressed about his financial affairs. Then he said that for the past three weeks he had noticed, in addition to this ten-year stomach distress, an unusual complaint—*i. e.*, fifteen minutes to an hour after meals, and increasing up to six hours after meals, he felt a *gnawing sensation in the abdomen.* This sensation was different from the feeling of fulness, and was relieved somewhat by the next meal. He also had this gnawing sensation at five o'clock in the morning, when he had often been awakened by it. That was the only gastric complaint he had, except that his stools contained a little mucus, and he noticed that if he got in a draft he would have a little diarrhea. His appetite was fair and he was sleeping fairly well, although he was worried. He said he had always been an excessive user of tobacco and likewise he had at different times drunk considerably. He was not married. Of recent years he had not drunk so much as formerly, but still drank considerably at times.

Family History.—His father died of apoplexy; his mother is living, but is said to have general arteriosclerosis and a mild glycosuria.

Previous History.—He admitted that six or eight years before he had had a rather severe Neisserian infection which was complicated with prostatitis and cystitis. He denied lues. Otherwise he had always been well except for the chronic stomach

complaints. He never had scarlet fever or diphtheria. He had a frontal sinusitis several years ago.

Examination.—He was a big, rather fleshy man, weighing 195 pounds, with a very short, "bull" neck. His eyes reacted promptly, his neck and throat were negative, his chest negative. Practically the only finding at the first examination was a moderate enlargement of the right lobe of the liver. He had always been a hearty eater, more or less of a gormand, and I attributed the increase in size to a fatty liver or else to an early cirrhosis. I gave him an Ewald meal, which showed a total acidity of 65; a motor meal showed the stomach empty in seven hours. Two stool examinations were negative for blood. I made a diagnosis of nervous hyperacidity, with possibly a fatty liver or early cirrhosis, and put him on a diet of cream and milk, urged him to have his vegetables all strained and used in the form of purées, and gave him a powder consisting of sodium bicarbonate and calcined magnesia, and told him to come back in two weeks and report.

He returned the first of August showing no improvement; the sensation of fulness was just as severe as it had been and the other symptoms were not relieved. He admitted that he was extremely worried about his business affairs, and we both thought it was probably the reason for the continuance of his ailment. He was put on various other lines of treatment, but without improvement, and finally, on the 23d of August, I urged him to come into the hospital for a more extensive examination.

Upon entrance to the hospital, when questioned by the intern, he made some statements that he had not told me; for instance, he said that two years before this time he woke up at two or three o'clock every morning for a week with severe abdominal cramps, and these were often relieved by a bowel movement. Likewise, that this pain would be particularly pronounced after eating pastry. Later, these pains began coming earlier in the morning, at one or two o'clock, and after a time a bowel movement would not relieve them. He also stated that for about six weeks before entering the hospital he was feeling weak, was easily fatigued, extremely tired and worn out. He also spoke of

the increasing pain which had originally been a full feeling or a gnawing feeling, but was now a definite pain and lasted for six hours. This pain began as an uneasy feeling in the lower abdomen, and later radiated upward to the stomach, sometimes involving the lower chest. It was described as colicky and was only relieved by taking medicine, or sometimes by a bowel movement. He had no special loss of appetite, but the diarrhea had become more frequent. Sometimes belching would relieve the pain, but that was rather difficult. *Two weeks before admission he was awakened at four o'clock in the morning by pain, and found that he had been bringing up blood, his pillow being stained therewith.*

Examination in the hospital again showed practically negative findings. His abdomen was fleshy and somewhat distended, especially in the lower portion. There was no visible peristalsis; there was some tenderness over the entire right side of the abdomen, especially over the appendix and gall-bladder regions. We percussed out the liver at that time, and it seemed *to extend down further than before and was slightly more tender.* We gave him additional test-meals at the hospital; an Ewald breakfast showed acidities of 50 and 76, with traces of chemical blood. The following day we repeated it, with readings of 45 and 50. A motor-meal was given and nothing obtained except a small amount (25–30 c.c.) of food streaked with blood. Stool examinations were frequent. I should say that out of twenty, four showed a positive Weber and the other sixteen were negative (on a meat-free diet). The urine was negative for albumin, sugar, cells, and casts.

He was fluoroscoped, with the following findings: "500 c.c. of bismuth meal given at 9.15; esophagus normal and stomach unfolds in a normal manner. The pylorus is to the right of the median line; the duodenum is not seen well. The peristalsis is rapid and there are no filling defects. There is tenderness over the entire pyloric and gall-bladder regions. One hour later there was marked peristalsis with much of the bismuth passed. Four hours later the stomach was completely empty." In other words, the gastro-intestinal examination was entirely

negative so far as gross evidence of ulcer or carcinoma was concerned.

This was about the situation around the first of September, but, in view of the several positive stools and the trace of blood in several Ewald meals, and the pain coming on in the early morning, we made a tentative diagnosis of duodenal ulcer and put him to bed on the routine ulcer management. This treatment was carried out very vigorously and conscientiously from the 24th of August until about the 5th of September, during which time he was exceedingly depressed, constantly complaining of pain and abdominal distress, and in every way making poor progress.

About the 7th or 8th of September, examination again revealed the same enlargement of the liver, and, for the first time, some *slight irregularities on the surface of the liver.* We were forced to conclude that there might be something more definitely wrong with the liver than we had at first suspected. A Wassermann was made at that time on account of the history of the Neisserian infection, but it was negative, as was also a later one. A rectal examination was made on the 8th of September, but nothing was found. On the 10th of September a note was made that both the liver and spleen were enlarged, and about this time he started to lose weight. On the 24th of September the liver was still larger, and by the first of October it was growing very rapidly in size. About the 14th of September he had a rather acute sudden pain in the right lower quadrant, associated with slight temperature and a leukocyte count of 14,000, with increasing tenderness and pain in this area, the characteristic picture of acute appendicitis. He was then seen in consultation, but there were no special suggestions made or changes in treatment. He continued to lose weight, became more and more irritable, and the liver continued to enlarge. About the first of October our differential diagnosis rested between an atrophic cirrhosis of the liver, with possibly malignant degeneration or adenoma formation, syphilis of the liver with multiple gummata (because of the irregular nodules that could be palpated), and carcinoma of the liver. These were

the three definite things that were considered. The question of a simple alcoholic cirrhosis or a fatty liver, as well as the diagnosis of chronic duodenal ulcer, seemed at this time extremely doubtful.

To make a long story short, he continued growing progressively worse, losing weight until he was a mere shadow of his former self, becoming pale and haggard looking, extremely irritable (requiring sedatives constantly), with increasing edema of the lower extremities. In short, the typical picture of an advanced cachexia. There was never any definitely demonstrable free fluid in the abdomen. The spleen was distinctly palpable as a firm, smooth organ. The liver mass kept growing constantly, the surface now was markedly irregular with elevations, sometimes hard and sometimes soft. In fact, in some of the larger elevations the periphery of the nodules seemed firm, while the center was softer. The liver finally extended down on the right side to below McBurney's point, almost reached the symphysis in the median line, and extended with irregular margins far over to the left, overlying the spleen, a hand's breadth below the left costal arch. At this time it was evident that exitus was not far off and his general appearance and condition were most pitiable. He finally died on the 28th of October, approximately three months after he first consulted me, and about four months after the onset of his trouble.

To summarize the history, course, and findings, it might be said that in a young man, forty years of age, with a preceding long history of "indigestion," there started, somewhat abruptly, a complaint of increased fulness and pain in the abdomen coming on late after meals and at night, associated with vomiting of blood, simulating, in short, the so-called ulcer history, at times examination showing blood in his stomach contents and in the stool, and an enlargement of the liver. Ultimately this enlargement became hard, irregular, and nodular, extreme cachexia developed, with death closing the fairly characteristic and not uncommon picture of carcinoma. All of this within a short period of four months.

An autopsy was performed by Dr. E. G. Kirk. As he will describe the postmortem findings in greater detail, I will simply

say that the liver was found grossly enlarged in all dimensions, weighing approximately 16 pounds; the lobes were all involved in a symmetric development. The surface of the liver was uniformly studded with various-sized elevated nodules, roughly circular in outline, many of which were umbilicated. Most of these were firm or even hard, but some were soft and fluctuated slightly. The color varied from grayish white to grayish yellow. What little liver substance remained was seen between the closely set nodules, and was of a reddish-brown color. On section the liver cut with markedly increased resistance, all lobes being uniformly filled with these spheric nodules. The nodules on section were firmer than the surrounding substance, but not so firm as cartilage, nor as the average metastatic liver nodules of carcinoma.

The stomach, grossly, was found normal in shape and position. There were no signs of ulcer or cancer. The appendix, intestines, and pancreas were normal.

A prolonged search for the original site of this cancer resulted negatively, although there were one or two findings which were suspicious. For example, a nodule was found in the left adrenal as well as a small nodule in the transverse colon, but from microscopic study these were shown to be of a secondary type. A rather large metastatic growth was found in the hilus of the left lung. The thyroid, prostate, pancreas, brain, spinal cord, as well as the long bones, were examined with no further evidence of the primary growth. It was concluded from this search that we had to deal with a primary carcinoma of the liver, a most rare and unusual condition.

I have brought over sections of this primary liver cancer for you to see, as well as microscopic sections of the nodules of the liver and the secondary deposits in the lung, adrenal, and colon.

While this case is of special pathologic interest from the standpoint of the rarity of primary carcinoma of the liver, it is likewise of unusual clinical interest from the standpoint of differential diagnosis. I brought these pictures and specimens over particularly to emphasize to you the difficulties of abdominal diagnosis and to discuss the fallacies and errors into which one is

apt to fall. The clinical picture of primary carcinoma of the liver was not very clear to me before this case was seen, and I have been trying since then to obtain a more definite symptom complex from the literature. There are two rather complete monographs on primary cancer of the liver. One in this country by Winternitz of John Hopkins; the other by Thöle of Hannover. Thöle has collected thirty-two cases of primary carcinoma of the liver and draws a fairly complete clinical entity from them. In this series men were afflicted more frequently than women, in the proportion of six to four; they occurred at a somewhat advanced age, between fifty and sixty years, although there were some in younger individuals. In this regard Thöle emphasizes the point that the younger the individual, the more rapid the progress and the worse the prognosis, as in our case. It may occur as early as the 27th year.

Symptomatology.—The initial symptoms of this group of primary carcinomas are those of many liver tumors, such as *vague dyspeptic complaints*, pressure and fulness, anorexia (particularly for meat), eructations and flatulency, later diarrhea, or diarrhea alternating with constipation; such complaints may last for weeks or months before the physician is consulted. However, even in the presence of enormous tumors, appetite and digestion may remain undisturbed and the carcinoma remain latent until death.

Hoppe-Seyler emphasizes particularly the *disturbance in appetite for meat and fatty foods* and the complaints of fulness and pressure in the *right* hypochondrium shortly after meals. He speaks, too, of the progressive loss in weight, even with the patient taking sufficient food, and describes the increasing pallor, the drying and lining of the skin, with its gray muddy subicteric tinge. Following this stage there appears later the *deep epigastric pain*, sometimes *radiating* to the *right breast* and *right shoulder, as in gall-bladder disease.*

The actual pain in this group of cases is for the most part slight, both subjective pain and tenderness on pressure. Apparently the intensity of the pain is dependent on the invasion and distention of the liver capsule. Pains are localized in the

epigastrium, radiating toward the back, the groin, the right shoulder, and the right leg. Cachexia rarely fails to develop, although in metastatic liver carcinoma one does occasionally see good nutrition and apparently good health until death. Progressive loss in weight with good appetite, adequate food intake, and absence of digestive disturbances is extremely suspicious of a malignant disease. Sometimes the cachexia begins with the first vague dyspeptic complaint, but oftener weeks or months later.

Fever with chills and leukocytosis may be present in liver cancer, although not necessarily speaking for an inflammatory process. The fever may have its origin in biliary retention from the obstructive position of the cancer; second, the fever may be from a hematogenous bacterial infection; third, it may occur without either of these conditions as the result of a central aseptic degeneration of a rapidly growing tumor with absorption of unknown toxic products. Jaundice occurs in primary cancer of the liver only when the tumor is placed so that it compresses the extrahepatic gall-ducts; not infrequently it does not appear until death. It is more frequent in diffuse multiple carcinoma and in cirrhosis carcinomatosis.

Eggel estimated that in all varieties of primary liver cancer *jaundice* occurred in *61 per cent.* of cases, *ascites* in *58 per cent.*, *edema* in *41 per cent.*, *splenic tumor* in *32 per cent.* Of these, our case showed complete absence of two of the most typical findings; namely, jaundice and ascites, although edema of the legs and splenic tumor were present.

The duration of the illness varies with different authors from twelve weeks to two years, with an average of six months. In general, the progression of the disease is a rapid one. In our case not more than four to six months.

The final picture is likewise an indefinite one, even as the initial symptoms are; they depend mostly on the position of the cancer, the early or late invasion of the blood-vessels with the deposit of metastases, the symptoms from compression of the gall-bladder, of the common gall-duct, or of the vena cava, the displacement of innumerable intrahepatic portal vein branches by tumor masses, producing in some cases icterus, ascites, edema,

splenic tumor, or superficial vein enlargement. With the advancing cachexia, ascites and edema from cardiac weakness increase, while progressive marasmus, with evidence of severe blood changes, as shown by internal and external purpuric areas, closes the scene.

Pathologically, it has been estimated that in about 11,000 autopsies there are approximately 200 carcinomas of the liver; of these 200 carcinomas from four to eight are primary; that is, for every 25 to 50 secondary cancers there is one primary. These primary cancers have been divided into three groups. First, the massive solitary carcinoma; second, the multiple nodular type, which is the class this case falls into, and which is the most common of these primary carcinomas; third, the so-called cirrhosis carcinomatosa, which is really a cirrhosis with carcinomatous degeneration of liver cells.

Dr. Kirk will describe at greater length the histology of these various primary cancers.

Considering this case, then, from this brief survey of the reported cases of primary cancer of the liver, it may be said that this patient of ours suffered from sensations of fulness and pressure after meals, which might have been due to the increasing enlargement of the liver itself. The "indigestion" of which he complained was so in accord with his long history of vague dyspeptic complaints for ten years that we laid little stress on it, although, as future events proved, it was of greatest importance. Likewise the feelings of fulness, belching, and bloating which he had had for ten years previous are the complaints from which these primary carcinoma patients suffer, as well as those afflicted with functional stomach troubles. As far as the bowels were concerned, he had occasional attacks of diarrhea, as these patients are said to have. As to loss in weight, our patient did not show any until very late; likewise he maintained his appetite until extremely late. He also had little pain, as these patients are said to have.

In short, this patient did have those *vague complaints* and feelings that primary carcinoma patients are said to have, and it might be well to emphasize here the striking fact that these

vague complaints are the complaints which go into the general description of *indigestion* or *dyspepsia*, and which in the large majority of cases are nothing but *functional indigestion*, but unfortunately in this patient were the forerunners of a grave abdominal disease.

There are several rather interesting points in regard to three physical findings in primary cancer of the liver which I wish to discuss very briefly. These are the questions of jaundice, splenic enlargement, and ascites in primary liver carcinoma. Jaundice was not present in this case, and a survey of the liver tissue would convince you that the absence of jaundice was due to a lack of sufficient liver parenchyma to manufacture bile. I forgot to mention previously that his stools were very light, clay colored—there was no bile in the stools.

While there was no true icterus present in the skin or mucous membranes, nor any positive bile tests in the urine, urobilinogen was strongly positive in the urine, as shown by the dimethyl-aminobenzaldehyd test of Ehrlich; this is of peculiar interest, inasmuch as the Ehrlich test is said to be negative in diseases of the liver due to cancer.

The absence of true icterus is of special interest as adding to the difficulty of diagnosis, inasmuch as 61 per cent. of all primary liver cancers have jaundice. Our case in this respect is similar to the case of Acland and Dudgeon in which no jaundice existed, although the entire liver of the fifteen-year-old boy was so strewn with cancer nodules that scarcely any liver tissue remained between them. This was precisely the fact in our case, and the thought was suggested, as mentioned above, that the absence of jaundice was due to the lack of sufficient bile-forming liver cells.

As to enlargements of the spleen in relation to enlargements of the liver, usually, as you know, in benign enlargements of the liver (such as cirrhosis and fatty liver), the spleen is enlarged, and it is generally believed that enlargement of the liver *without* splenic enlargement suggests cancer, while enlargement of both liver and spleen rather speaks against malignancy. This man's splenic enlargement was probably due to a chronic passive con-

gestion. At all events, the presence of a splenic tumor does not necessarily speak against malignancy, as this case well shows.

Now the question of ascites: This man had no ascites antemortem, and postmortem he had only a small collection of fluid in the abdomen. This speaks for cancer. In late cancer of the liver, where it does occur, it is probably due to myocardial weakness or to a gradually progressing anemia. In the event that the cancer nodules are so situated as to cause compression of the portal vein or the inferior vena cava, or displacement of the intrahepatic branches of the portal vein, ascites, edema, splenic tumor and superficial vein dilatation are usually present. In other cases, without such deposits, these symptoms are absent. When ascites and edema of the legs are prominent symptoms it is probably more often the expression of general marasmus, cachexia, and cardiac weakness. Peritoneal metastases, it will be remembered, frequently produce a hemorrhagic ascites.

Differential Diagnosis.—We spoke about the differential diagnosis between cirrhosis, syphilis, and secondary carcinoma. What other things enter into the differential diagnosis of enlargements of the liver?

INTERN: Echinococcus, amyloid liver, passive congestion, abscesses in general.

DR. HAMBURGER: Yes, and obstructive jaundice, leukemia, Hanot's cirrhosis, Banti's disease, Hodgkin's disease, and many others.

Now, very briefly, just speaking of the typical findings in cirrhosis and fatty liver, they are an enlarged, smooth liver, ascites, enlarged spleen, a history of alcoholism, findings of blood in the stomach contents, etc.

Syphilis of the liver is tremendously interesting, and I may have occasion to show you some cases. In some instances you see surface irregularities similar to the nodules of carcinoma, but they are usually soft; probably a more characteristic feature is that you find irregularities along the palpable edge of the liver; in an enlarged liver you should always palpate the edge for these irregular areas, which are so characteristic of tertiary syphilis. So, soft elevations, discrete gummas, irregular

liver margin, and sometimes slight elevation of temperature are among the principal characteristics of hepatic syphilis.

Secondary carcinoma of the liver: The man we saw this morning probably has a carcinoma of the liver. Very often the nodules are soft around their edge, while the nodules of syphilis are soft all through. Then, of course, there is the finding of carcinoma elsewhere, frequently of the stomach, less frequently of the cecum, colon, rectum, prostate, seminal vesicles, etc.

In echinococcus of the liver one sees a large cyst or cysts which are most frequently solitary, but sometimes multiple. You may get a peculiar thrill upon palpation, from the presence of daughter cysts contained within the mother cyst. It has a long, chronic course, without much progress one way or the other.

In amyloid liver the surface is smooth and fairly hard. It occurs in syphilis, without jaundice; it occurs with enlargement of the spleen, and it occurs with tuberculosis of the lung or elsewhere, and is often associated with a focus of suppuration.

In obstructive jaundice the liver is enlarged and smooth and hard, the spleen is usually enlarged, and the icterus is profound.

In amebic abscess or other abscesses of the liver there is often a discrete localized area of extreme tenderness, associated with a hyperleukocytosis, and frequently with a history of diarrhea, or even a history of multiple abscess. The liver itself is often not very much enlarged.

Cirrhosis (Hanot's) occurs in young individuals, especially in young boys from twelve to twenty years of age, and is associated with jaundice, with ascites, often with leukopenia, and the liver itself is large and firm.

In leukemia the liver is large and smooth and the spleen is enlarged.

The only point that is of interest in regard to passive congestion of the liver is, that when the liver is very large and associated with heart disease you should bear in mind the heart lesion; often as the heart improves the liver will get smaller, but frequently it does not. You must bear in mind that it may be syphilis or fatty liver or an early cirrhosis in such an event.

In Hodgkin's disease, where the enlargement of the glands is relatively small, the enlargement of the liver and spleen may be very great. There are usually other characteristic findings, such as the general adenopathy (beginning in the axillary and cervical glands), the frequent febrile attacks, etc., etc.

All these things must be carefully considered in the differential diagnosis of enlargements of the liver.

Treatment.—As far as treatment is concerned, successful treatment of cancer of the liver, primary as well as secondary, is as unsatisfactory and hopeless as the treatment of cancer elsewhere. The only possible chance of permanent cure naturally lies in an early diagnosis, with the intervention of an exploratory laparotomy and the finding of a small solitary primary cancer located in such a position that the mass can be resected. Thöle, in his "Chirurgie der Lebergeschwülste," collects 32 resections for liver cancer, of which 19 were for "primary carcinoma," of which, by a particularly careful scrutiny, 10 remained that were positively primary. Of the other 9 patients, 4 died immediately after the operation, and 5 died within from two and one-half to nine months. Seven of the 32 which were excised as primary cancer were, in reality, secondary liver metastases.

The results of the 10 true primary carcinomas are interesting. One of these cases died immediately following the operation from operative collapse. The ultimate result in one carcinoma was not obtainable. Four of the remaining 8 died within from two months to four and one-quarter years. Of the remaining 4 cases, 1 was reoperated within nineteen months for a recurrence, the remaining 3 are still living at sixteen months, three years, and seven years, respectively, after the operation.

As Thöle remarks, there are two ways of diagnosing primary carcinoma of the liver: (1) That the patient remains well at least four years after the liver resection; (2) that, as in this case, after a careful, complete autopsy, no other primary focus of cancer can be found.

Discussion of the Pathology

By Edwin G. Kirk, M. D.,
Pathologist to the Michael Reese Hospital.

To summarize the more important autopsy findings: The *peritoneal cavity* is essentially normal. There are no adhesions and no ascites.

Fig. 112.—Liver. Anterior view; compared with 12-inch ruler.

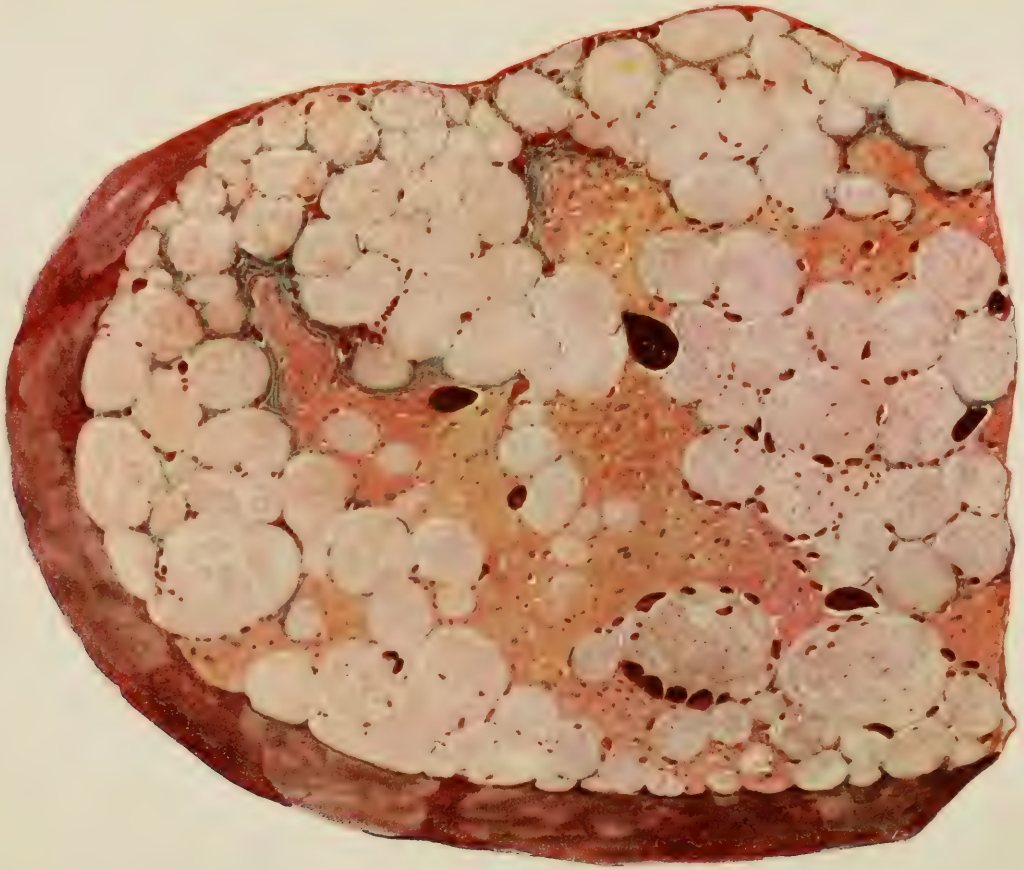
The *liver* is greatly enlarged in all dimensions, extending 7 cm. below the umbilicus and coming in extensive contact with the right and left lateral peritoneum. The weight is 7537 grams (16.6 lb.). The organ is equally and symmetrically enlarged, so as to preserve essentially the form of a normal liver. You see (Figs. 112 and 113) that the surface is studded with nodules, roughly

circular in contour, but often polygonal from mutual pressure, and varying in diameter from 4 cm. downward; many project one centimeter above the surface of the liver; some are slightly umbilicated; most are firm or even hard, but some are softened or fluctuate slightly; the color of the nodules varies from a lustrous grayish white to a subdued grayish pink. The peritoneum cover-

Fig. 113.—Liver. Posterior view; compared with 12-inch ruler.

ing the liver is everywhere injected, thus lending a slightly pinkish hue to even the whiter nodules. On *section* (Fig. 114 and Plate I) the liver cuts with increased resistance. All lobes are uniformly filled with the nodules, which on section are firmer than normal liver substance, but not so hard as cartilage or as the average metastatic carcinoma of the liver. They are of

PLATE 1



Section of liver.

Section of adrenal, showing nodule.

spongy appearance on section, many of them softened centrally, and many showing numerous minute punctate hemorrhages. The small strands of liver substance which persist between the nodules are brownish red, or in places greenish brown, as though slightly stained with bile pigment. The nodules themselves are never bile stained. Our first impression is that we almost certainly have multiple carcinomatous nodules. The whitish color, firm consistency (except where secondary softening has occurred), and the general appearance of the nodules all suggest carcinoma, but where is the primary growth?

Fig 114.—Section of liver in gross.

The *gall-bladder* is normal and contains thick, dark-green bile, and also 40 or 50 black, faceted stones about one-sixth the size of a pea. Gall-bladder, cystic duct, common duct, and both hepatic ducts are patent and normal throughout.

Careful search of stomach, small intestine, and pancreas gives absolutely negative results as to tumor.

We found the lymph-nodes scattered along the common bile duct and portal vein to be greatly enlarged, hard, often fused, and glistening white on section. Many show central hemorrhage and necrosis. They are obviously involved in the same metastatic process. Also the receptive lymph-nodes into which this hepatic chain drains, namely, the pre- and juxta-aortic

glands along the upper border of the pancreas, are similarly involved.

In the *thoracic viscera* the only major findings are the extensive involvement in the same metastatic process of the lymph-glands about the hilus of the left lung and in the posterior mediastinum (*i. e.*, those about the bifurcation of the trachea). Many are 3 to 4 cm. in diameter, very hard, and in places fused to form a pinkish-white tumor mass. The *pleuræ are not involved* and the left lung only slightly, by direct extension from the broken-down hilus glands.

The left *adrenal* is slightly enlarged, weighing 12 grams. On section (Fig. 115) you perceive a small nodule situated at the upper pole, in the medullary part. It is 6 cm. in diameter, hard and glistening white, except for numerous minute punctate

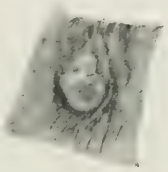


Fig. 115.—Surface view of colon polyp. Natural size. When this photo was taken one-half the nodule had been removed clear to its base for serial sections. Subsequently the entire nodule was sectioned.

hemorrhages. The presence of this small nodule, obviously neoplastic, raises several questions. Could this be the primary tumor, one of the so-called malignant adenomas (Ribbert), or atypical hypernephromas (Birch-Hirschfeld)? These neoplasms often develop tremendously large and wide-spread metastases from small primary tumors. But those tumors are lemon-yellow, greenish-brown, or brown-red in color; moreover, they are moderately soft. This one is hard and white, except for vascularized areas and punctate hemorrhages. Moreover, we found the regional lymph-nodes to be extensively involved in the tumor process, as also the glands at the root of the left lung, the pleuræ being normal. Hypernephromas almost always (Ribbert maintains *always*) metastasize via the veins rather than the lymphatics. Carcinoma, on the other hand, often travels

via the lymph routes. Moreover, we should expect a hypernephroma with metastases as large as those involving this liver to have invaded the pleuræ and bones, both of which are here negative. Another possibility that we had to consider was of a benign adenoma (*typical* hypernephroma of the adrenal) as an accidental occurrence and having nothing to do with the liver neoplasm. But what we said regarding color and consistency applies as well to the benign. This white nodule is almost certainly carcinomatous, and we travel the path of least resistance in considering it as secondary to some other growth (*vide* Microscopic Examination below).

You saw in the *descending colon*, at a point just above the sigmoid and on the left border, a small circular, button-like elevation of the mucous membrane, raised 4 mm. above the general level and measuring 1.2 cm. diameter (Fig. 115). At first we designated it as a sessile polyp and believed it benign. It is movable on the underlying musculature. The colonic mucous membrane covering it is normal, except for a slight superficial abrasion or ulceration at the central part. The polyp is not visible and is only slightly palpable from the external aspect of the gut. On palpation the polyp feels pretty firm, almost cartilaginous, and on section it is seen to be no ordinary polyp, for it consists of a hard, white nodule lying wholly in the submucous coat; it is suggestive of carcinoma. Could we have here the primary tumor? Such small polypoid carcinomatous growths of the intestinal tract do occur, and sometimes give rise to proportionately tremendous and extensive metastases. We examine it closely and find that the muscularis is not invaded. What is more important, the mucous membrane appears to be nowhere continuous with it and is slightly movable over it. This speaks somewhat *against* its being the primary growth and *for* a metastasis. Moreover, the fact that this nodule appears to be definitely located in the submucosa (the coat rich in lymph-vascular supply) suggests a metastatic nature. Nevertheless, we ought not to permit ourselves to decide conclusively on this until the whole nodule has been examined microscopically (*vide* below).

Finally, you remember we searched minutely for a possible

primary seat of cancer in the thyroid, oro- and nasopharynx, esophagus, stomach, intestine, rectum, pancreas and its ducts, ampulla of Vater, common bile-duct, cystic duct, gall-bladder, right and left hepatic ducts, and all the larger tributaries of the latter, also the prostate, urinary bladder, seminal vesicles, kidneys, ureters and epididymis, testes and all areas of the skin, with absolutely negative results.

Fig. 116.—Nodule in suprarenal (14 diam.).

We feel that we have not found a primary tumor elsewhere, and we turn back to the liver as the possible site of such. The character of the nodules enables us from the first to rule out the *cirrhoses*, also tuberculosis, for even the excessively rare, large, tumor-like *conglomerate tubercle* of walnut-size never presents the great multiplicity and hard character of the present growth, with

absence of caseation and of chronic granulation-tissue reaction; the same is true of the very rare large *nodular gummata*, for they never present the firmness and white color of some of the present nodules, their color is more grayish and yellowish, and there is more marked grumous softening, especially in nodules of this size.

Secondary actinomycosis rarely occurs in nodular form, but even without reference to the absence of primary foci we can rule it out, for the nodules of actinomycosis are yellowish, more spongy, and infiltrated with pus or displaying multiple abscesses. In the rare nodular type of *lymphoma* the nodules are softer, and on section pale reddishg ray to yellow; never so large, hard, or sharply circumscribed as the present ones. The *sarcomas* of the liver need only to be thought of to be dismissed. Their color is more reddish, the vascularization more pronounced, the consistency softer, and the borders not so sharp.

The general appearance of these nodules, and especially their variegated and mottled appearance on section, suggest that this may be one of the rather rare *primary cancers* of the *liver*.

Fig. 117.—Microgram of colonic nodule (12 diam.). The carcinomatous tissue lies for the most part in the submucosa, and at *no* point involves the mucosal epithelium. From a series.

MICROSCOPIC EXAMINATION

(1) The *suprarenal nodule* (Fig. 116) is a secondary adenocarcinoma of the same histologic type as the liver nodules.

Malignant adenoma and hypernephroma are absolutely excluded. The adrenal tissue immediately bordering the expanding nodule shows pressure atrophy.

(2) The *colonic* polyp (Fig. 117) is a carcinomatous metastasis of similar structure. The surface and glandular epithelium is nowhere hyperplastic, nor is it continuous at any point with the nodule. Complete serial sections, many hundreds in all,

Fig. 118.—Microgram of small liver nodule with surrounding liver tissue (32 diam.).

were made of this nodule, and thus its secondary nature proved. The slight ulceration of the mucosa over the central portion is due to a cutting off of the normal vascular supply by carcinomatous invasion of the underlying submucosal vessels.

(3) The lymph-glands show the same type of adenocarcinoma (see below).

(4) The liver nodules consist (Figs. 118, 119, 120) largely of high or low cylindric cells, closely resembling those lining the

smaller interlobular bile ductules. They are arranged as glandules and tubules, or in places as solid strands or irregular masses. There is a small amount of stroma, well supplied with thin-walled vessels. This conforms absolutely to the type of primary liver carcinoma supposed to be derived from the smaller bile ductules (carcinoma cholango-cellulare; cholangioma). On ex-

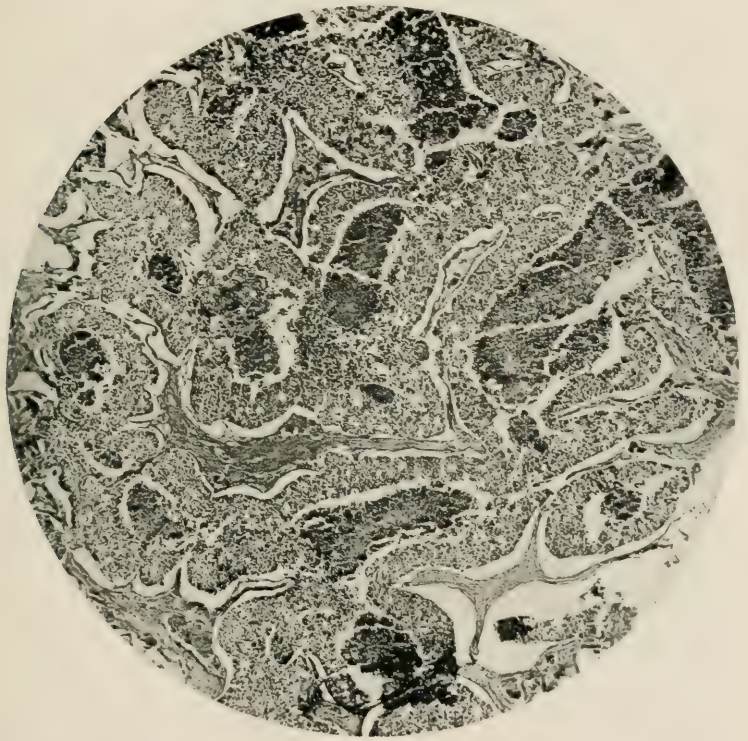


Fig. 119.—Microgram of liver nodule (45 diam.), illustrating characteristic arrangement of stroma and carcinomatous parenchyme. Note necrotic areas.

amination of many nodules we find no trace of the other type of primary liver carcinoma, that which originates from the liver parenchyma cells—carcinoma hepato-cellulare or hepatoma. Some observers have claimed to find the two types side by side in the same liver. We find all nodules to be sharply delimited from the adjacent liver tissue, there being absolutely no tran-

sitions between normal ductule epithelium and the cancer cells (see Bundschuh, 1914).

In gross characters this tumor does not conform to the *massive* type of Hanot with a single, large primary nodule, or to the rare cancer with cirrhosis which simulates Laennec's alcoholic

Fig. 120.—Detail from a liver nodule (250 diam.).

cirrhosis closely. It does, however, correspond in every way with the third gross type, namely, the *nodular* type.

It has been sometimes said that umbilication of the nodules, which occurs in our case, is almost pathognomonic of secondary carcinoma of the liver, but Thöle (Leber Geschwülste) and other modern authorities have shown it to occur both in secondary and primary carcinoma of the liver.

THE SCHICK REACTION[1]

Interpretation of Toxin and Control Tests. Its Value in Cases of Serum Susceptibility and Ordinary Sore Throats.

By Dr. George H. Weaver,

Of the Durand Hospital of the Memorial Institute for Infectious Diseases.

I have not prepared a paper, thinking it would perhaps be more interesting to discuss in an informal way some of the leading points connected with the Schick reaction. It is now some time since it was first introduced, and I don't think it necessary to go very much into detail on a subject with which you are probably familiar. We may, however, speak briefly regarding the principles underlying the application of this test. Schick's test is a test for a condition of immunity against diphtheria toxin. As you know, the changes in diphtheria are due to the action of the toxins produced by diphtheria bacilli at the point of infection. Immunity against diphtheria depends upon the presence in the body of the patient of antitoxin; *i. e.*, the specific diphtheria antitoxin. A person is immune, is insusceptible to the action of the diphtheria toxin, because immediately after the toxin is introduced it is neutralized and, therefore, without effect. Schick's test depends upon this fact. The technic is carried out in the following manner: A diphtheria toxin (which is simply a solution of the products of diphtheria bacilli and contains the toxin) is first standardized as to its effect upon guinea-pigs, and the smallest amount of the toxin which will kill a 250-gram pig is determined. This amount is known as the minimal lethal dose. When this dose for guinea-pigs has been determined a certain small amount of it (about $\frac{1}{50}$ of the M. L. D.) is used in man for making the test. This toxin is injected into the skin, as is done in the tuberculin test. The injection is intra-

[1] A talk before the West Side Branch of the Chicago Medical Society at the Cook County Hospital, October 21, 1915.

cutaneous and the amount that is injected is $\frac{1}{50}$ of the dose which is sufficient to kill a guinea-pig. The toxin is so diluted that the required amount is contained in $\frac{1}{10}$ c.c., the dilution being made with physiologic salt solution. When the test is to be made the injection is made with a finely graduated syringe which will inject accurately $\frac{1}{10}$ c.c. A very fine needle with a sharp and rather short point is needed in order that the opening of the needle shall be covered as soon as possible after it passes into the skin. When the fluid has been injected and the needle withdrawn the opening closes. When the injection is properly made there occurs at the point of insertion a slight whitish blister-like, punctate-appearing elevation, the slight depressions corresponding to the hair-follicles.

During the last year we have also used a control injection, as advocated by Groër and Kassowitz. This control injection is given in the opposite arm from that in which the first injection is made. We are accustomed to making the injections about the middle of the outer side of the arm. This control injection contains the same amount of toxin as the first injection, together with several hundred times the necessary antitoxin to neutralize the poison. If the patient has no antitoxin in the blood, after twenty-four to forty-eight hours there develops what we call a reaction. This reaction appears as an area of redness, a centimeter or a little more or less in diameter, sometimes two centimeters; $1\frac{1}{2}$ centimeter is about the average. Together with the redness there is a little swelling; but there is not much elevation. The redness is fairly sharply outlined and is a little brighter than that which occurs in the tuberculin reaction. If the patient, however, has even a small amount of antitoxin in the blood then nothing occurs when the toxin is injected, and we have what we call a negative reaction; that is, absence of reaction. If a positive reaction occurs in a patient who has no antitoxin in the blood there is an absence of reaction in the control arm. The toxin in the control arm was neutralized before it was injected. In every case in which a reaction appears in the test arm and no reaction in the control arm the person is susceptible to diphtheria.

There are certain cases in which it is very difficult to tell whether there is a positive reaction or not, because we have what are spoken of as pseudoreactions. Pseudoreactions are explained in different ways, and probably are due at times to different causes. They apparently are largely due to the products of the diphtheria bacillus which are in the solution, but are not in the nature of toxin; bacterial products which call forth some reaction in the tissues and are not neutralized by the diphtheria antitoxin. In a case in which we have antitoxin in the blood we may still have a pseudoreaction. The pseudoreaction occurs in the control arm as well as in the arm which receives the injection of toxin only. The pseudoreaction comes on very rapidly, and, as compared with a true reaction, there is apt to be more swelling and it is more transient, disappearing usually inside of two or three days. The positive reaction, after reaching its height in twenty-four to forty-eight hours, fades very gradually, so that at the end of a week there is still some redness remaining. The redness first becomes less vivid, changing later to a brownish tint, and there finally remains a little area showing brownish pigmentation and commonly slight scaling. That is the typical course. Pseudoreactions usually disappear in two or three days, leaving no pigmentation or desquamation.

Now, as to the frequency with which these positive or negative reactions occur: We understand if the patient has a positive reaction that the patient does not possess diphtheria antitoxin; a negative reaction, that the patient has diphtheria antitoxin, and is immune to diphtheria toxin and consequently immune to diphtheria infection.

Among infants experience has shown that 85 per cent. are immune to diphtheria, only about 15 per cent. giving a positive reaction. Of those between two and five years of age about 65 per cent. give a positive reaction, showing that we have between those ages a large proportion of children who are susceptible to diphtheria. From five to fifteen years of age the proportion of susceptibility is about 50 per cent. The percentage of susceptibility gradually decreases as age increases, and from fifteen years on the percentage of susceptible individuals falls, so that

somewhere between 10 to 20 per cent. of adults are susceptible to diphtheria. Among the last forty normal individuals whom we injected in the routine use of the test there were 20 per cent. susceptible and 80 per cent. immune. The generally accepted explanation for this presence of so-called normal antitoxin is as follows:

Infants inherit their antitoxin from the mother, and it is transferred through the placental circulation direct to the child, so that the child is born with immunity and is immune until, in the majority of cases, it reaches the age of one or two years and sometimes until it is much older. The gradual elimination of this inherited antitoxin results in an increasing proportion of susceptible children up to about five years. The decreasing susceptibility to diphtheria after that age probably can be explained by the occurrence of diphtheria, often mild and unrecognized, which is followed by more or less permanent immunity.

Now we will briefly speak of some of the practical applications of the test. In the routine use of diphtheria antitoxin for immunizing purposes there is a good deal of discussion as to how it should be used. When first introduced, you remember that the statement was made that diphtheria antitoxin was entirely harmless, that anyone exposed should be immunized, without regard to age and without any possibility of danger. Larger experience, however, has shown that there was connected with the injection (even in the small doses necessary for immunization) a certain amount of danger, not usually danger to life, but danger of certain uncomfortable occurrences, and very occasionally danger for the life of the person. And not only was there the immediate danger or discomfort which accompanied the serum reaction, but also by the patient being sensitized to horse serum; there was the remote danger that if subsequently horse serum were injected a violent reaction might ensue.

We have in this Schick test a means by which we can pick out those individuals who are susceptible to diphtheria. In institutions for children when an epidemic is prevalent, and in any case when individuals are exposed to infection, by testing in this way we can pick out those who are susceptible. The others being

already immune require no antitoxin and there is nothing gained by giving it to them. Thus immunizing injections of antitoxin can be restricted to those who lack it. Also, there is the matter of expense, which should be taken into consideration where a large number of injections are given.

We have been following this diagnostic method in the nurses as they have entered the Durand Hospital for about two years. Before that time nurses would not infrequently develop diphtheria; every once in a while a nurse on duty in the diphtheria ward would become ill with the disease. These cases naturally, being treated early, would recover, but the nurse was laid up for a while and it was an inconvenience besides. So we began to administer the Schick test to the nurses when they came into the hospital, and those who were susceptible to diphtheria were given 1000 units of antitoxin. Since that has been followed not a case of diphtheria has occurred among the nurses. There have been one or two carriers, but they have not developed diphtheria.

This test is sometimes of use in determining whether a patient is in danger of infection with diphtheria where we have doubt as to the propriety of administering serum to that patient. A while ago a doctor came to me with this story: He had a daughter about five years old that was subject to asthma when she came in contact with horses. There was an epidemic of diphtheria where they lived, and he was afraid the child might contract diphtheria; he was fearful of giving her antitoxin, either for immunizing or therapeutic purposes. I gave him some of the solution for making a Schick test, which he did, and it was without any effect, showing that the child was immune to diphtheria. So he was immediately relieved of further anxiety, because the child would not get diphtheria and there would be no occasion to give any serum under any circumstances.

There are other cases where the test is of considerable value. It is useful as a diagnostic aid in cases of anginas of various sorts. As you know, there are cases of tonsillitis, cases of syphilis and other anginas, where the appearance of the throat is suggestive of diphtheria. We have been in the habit in such cases of giving

the Schick injection immediately when the patient comes under our observation, at the same time making a culture from the secretion of the throat. These cases are not usually urgent. At the end of eighteen hours, if the patient gives a positive reaction and diphtheria bacilli are found by culture, antitoxin is given. At the end of twenty-four hours, if there is an absolutely negative reaction, showing the patient is not susceptible to diphtheria, then antitoxin is not given, even though the cultures may be positive, because it has been shown by a large number of observers that in all cases of active diphtheria the patient gives a positive reaction; a patient with a negative reaction is not suffering from the effects of diphtheria poison. In this way we can pick out cases of angina which are diphtheria bacillus carriers, but are not cases of true diphtheria. We used to think or acted upon the supposition that every case of sore throat from which the diphtheria bacillus could be cultivated was diphtheria, but attacks of tonsillitis occasionally occur among those who are in contact with diphtheria which are due to other infections than diphtheria, and, of course, do not require antitoxin.

Carriers, we may say, are always immune to diphtheria; they have a large amount of antitoxin in their blood.

There are one or two points that have come up in connection with the control injection (which consists of a small amount of antitoxin in connection with the toxin). There are certain individuals who are hypersensitive to horse serum, and we sometimes find that those individuals may develop a marked local reaction in the control arm due to the serum itself, not due to the toxin, and in that way we have picked out persons who are hypersensitive to horse serum. One such case was a nurse, who received the injections in both arms; the toxin injection was entirely negative. In the other arm there was a swelling three or four inches in diameter. This subsided in a few days and was due apparently to horse serum. It is quite possible if this woman had been injected with the ordinary dose of diphtheria antitoxin without our suspecting the condition that she might have suffered from a severe serum reaction. It developed afterward that she was subject to severe urticaria. In such a hyper-

sensitive person diphtheria antitoxin should be given very cautiously, beginning with a very small dose.

I hope nothing I have said will be construed as indicating that I would restrict the use of antitoxin in diphtheria. It should be given in every case as early as possible and in sufficient quantity to control the disease. The danger from diphtheria is so much greater than that from the very rare severe serum reaction that fear of the latter should not in the least deter one from administering antitoxin in every case of diphtheria. I do not wish to detract from the great value of immunizing injections of antitoxin in children exposed to infection, but only to urge that such children as are already immune be spared what is at least valueless in their cases.

CLINIC OF DR. CHARLES LOUIS MIX

MERCY HOSPITAL

UPPER LOBE PNEUMONIA

Prognostic Pneumonic Triad. Watching the Heart the Key to Successful Treatment. Therapeutic Measures and When to Apply Them.

DR. MIX: The first patient we have this morning (March 30, 1915) is a young man, twenty-eight years old, who has been in the hospital two days. You will notice that his face is rather flushed, that he looks feverish, and that he has cold-sores on both the upper and lower lips. (To Patient): When did these cold-sores come?

PATIENT: About a week ago.

DR. MIX: Before you had that chilly sensation you spoke of?

PATIENT: Yes, a day before.

DR. MIX: They came on, then, six days ago. He gives the following history: He has been sick since the twenty-fifth of March, the cold-sores came on the twenty-fourth; on the twenty-fifth he had a slight chill, which lasted for only a few minutes and did not amount to much. A week previously he had a few transitory cramping pains in the epigastrium, but he kept at work, and on Thursday he began to have these pains higher up and so severe that he had to stop work and go to bed. It is thus evident that some very severe infection took him off his feet in a day, associated with cold-sores and a slight chill. Ordinarily one would suspect in such a situation a rather severe chill.

He has had a high fever from the very start. This was followed by a cold sweat. He was in bed all Friday morning, then got up and went a few doors away to get shaved, and then went home and went to bed again. He has a cough which has persisted for seven months and which has increased since this illness began.

As to past illness: There have been no sicknesses so far as he knows, except last year, when he had a sore throat and sour stomach with nausea and vomiting. (To Patient): Can you tell me a little more about that trouble?

PATIENT: Not much; I was weak and could not walk much.

DR. MIX: He is too ill to be persecuted very much by questions.[1]

Examination of the urine shows albumin, but no casts or blood-cells, the specific gravity being 1021. Blood examination on the twenty-ninth showed a leukocyte count of 14,200 and a blood-pressure of 122. When he entered on the twenty-eighth he had a pulse of 140, temperature of 103° F., and respiration 52. After resting five hours his pulse fell to 116, his temperature to 101.8° F., his respirations to 30. On the twenty-ninth his pulse varied from 130 as a minimum to 154 as a maximum, and his respiratory rate varied from 28 to 56; his temperature was fairly steady, the minimum being 100.6° F., and the maximum 103° F. in the armpit.

One of the most noticeable things about him this morning are the cold-sores, the perspiration on his face, the flushing of his face, the rather rapid breathing, and his cough, which is not particularly tight, but fairly loose. The pulse-rate this morning is 132; there is a good deal of perspiration on his hands, more than there should be in an ordinary pneumonia, and, indeed, he is sweating all over.

Now we have first to find out whether he has a pneumonia or pleurisy with effusion. He evidently has a pneumococcic infection of some sort, as evidenced by the cold-sores. On examination of the chest you will notice that the lower lobes on both sides are about equal in their resonance and fairly normal. In the back the dulness begins at a point which is just a little above the spine of the scapula and slightly above the fourth dorsal vertebra.

The next thing we have to determine is whether there is any

[1] After the patient's recovery he had no knowledge of ever having been in the amphitheater, much less of questions put to him and answers he gave. So it is often in pneumonia when a patient seems fairly rational.

disturbance in the middle lobe of the right side. Now, upon percussing down over the chest, when we get to the lower lobe you note by the resonance that there is no question about its freedom; but when we get to the middle lobe resonance is somewhat involved and when we percuss over the upper lobe we find it entirely consolidated. Already, then, we have disposed of the question as to whether there is a pleuritic effusion because of the fact that there is dulness over the upper lobe; an effusion dulness over the lower lobe and never over the upper, with resonance over the lower. Inasmuch as we have dulness over the upper lobe where fluid can't accumulate, with a lower lobe free from dulness, we know that there is no pleuritic effusion at this time.

Now we must listen to the breathing and hear how the sounds are coming through the diseased lung. There is on the left side a little overactivity of the lung; this you can see as he breathes. You notice that the inspiratory act in the left chest is a little better than that of the right. When you listen over the area of the right lobe you find most exquisite bronchial breathing without râles. I want some of you to come down and listen to the breathing and contrast it on the two sides of that chest. You have an exquisite example of what bronchial breathing is; do you hear any râles there?

VISITOR: No.

DR. MIX: No; all you hear is the air passing into the bronchi, not into the air-cells at all; there is a great difference on the two sides.

We have thus added to our physical findings the presence of marked bronchial breathing, often called tubular breathing, but not of an intensity great enough to constitute amphoric breathing. This is the characteristic type of breathing in pneumonia in the middle of its course. *There are no râles.*

The next question is whether he has, as he should in a case of this sort, any exaggeration of his tactile fremitus.

(To Patient): Will you please say one, two. Yes, there is some, but not so much as might be expected from his intense bronchial breathing. Now we must correlate that with the vocal

resonance and whispered breath. (To Patient): Now say one, two—now whisper it. The whispered breath is transmitted beautifully, thus proving consolidation.

We have, by the way of summary of the symptoms, an acute illness beginning, contrary to rule, with a slight chill instead of a very severe rigor. Practically all cases of pneumonia begin with a very severe rigor. This, however, began with a comparatively mild rigor. He had rather what one might call a chilly sensation rather than an actual chill; it lasted only a few moments and did not bother him much. Preceding this chill were the cold-sores. Cold-sores are the mark of a pneumococcic infection. Many bacteria show their hands as clearly as many of the infectious fevers. The pneumococcus shows itself by the cold-sores. To look at this man one would say, even on going into the ward, before examining him, that there is a pneumococcic lobar pneumonia.

In addition to these symptoms of great acuteness taking him at once off his feet, we have, by way of summary of the physical signs, dulness over the right upper and middle lobes. In the back the dulness is slightly below the line of demarcation between the middle and lower lobes, because when the upper lobe consolidated it pushed down the interlobar fissure a little bit. We also find a slight amount of sluggishness in the expiratory phase of the right side of the chest as compared with that of the left. That is due to the overactivity of the left side and the underactivity of the right side because of the consolidation.

On auscultation we find distinct bronchial breathing. This breathing is not associated with the presence of râles. His pneumonia, then, is right in the exact center of its course, in the stage of complete consolidation, before the stage of gray hepatization has set in, and after the stage of beginning consolidation has passed. I think the stage of gray hepatization is beginning to come because he is perspiring a good deal, yet since he has been sick only six days a crisis is not to be expected so soon. The vocal resonance and the whispered breath sounds are fairly clear over these two lobes.

By way of summary, then, of the physical findings, we have

(1) a lagging of the right and overactivity on the left side of the chest.

(2) On percussion we find dulness over the whole right upper and middle lobes.

(3) We find on auscultation bronchial breathing confined to the area of consolidation. We also find vocal resonance and tactile fremitus increased over the affected area. Since it is the apex and upper part of the lung which is involved it can't possibly be a pleurisy. No differential diagnosis between pneumonia of the upper lobe and pleurisy is possible because a pneumonia always produces its dulness there and pleurisy always produces its dulness at the base of the lung. There is a differential diagnosis between pneumonia of the lower lobe and pleurisy, because both pneumonia and pleurisy can produce the same sort of dulness in the same location.

Prognosis.—We must now turn our attention to the condition of his heart, because his whole prognosis depends upon that. You can easily see that the behavior of the right side of the heart must be greatly affected in any case of pneumonia. It is the right side of the heart that has to pump the blood through the lung. There is a great deal of pathology in the lung, and the right side of the heart must drive the blood through that consolidated area. Unfortunately the patient suffering from pneumonia is always very toxic, and this toxicity exerts a great effect upon his heart, so that at the time the heart is called upon to do the maximum amount of work, it is, by reason of this toxemia, the least able to do it. So you see we have an unfortunate state of affairs in almost all pneumonias—a weakened myocardium of the right heart and increased work for it to do. How shall we know from day to day whether the right side of the heart is getting on all right? Can any of you think of any test? Yes; we can know if we observe *the condition of the second pulmonic sound.* It should be a little plus, should it not? If it is plus, everything is fine; if the pulmonic second is less than normal then things are not very roseate as to prognosis.

There are three prognostic points indicated by the heart, having to deal with this same subject of toxemia. The first

point was just mentioned, the degree of accentuation of the pulmonic second sound. The second point, which is of great importance, is *the relation between the pulse-rate and the blood-pressure;* the blood-pressure should be greater than the pulse-rate. For example, if you have a man with a blood-pressure of 120 and a pulse-rate of 140, look out for his life. If the pulse-rate exceeds the blood-pressure the prognosis is usually bad—not absolutely or entirely so, but usually so. A third point, which is very important indeed, attention to which was called by Mackenzie of London, is *arhythmia.* It is said that, except in a senile heart, cases of pneumonia showing arhythmia always die. If the myocardium is a senile myocardium then recovery may take place. I have seen only two cases with arhythmia recover, and these were both in patients above sixty-five years of age.

On examining his heart, we find that, so far as palpation is concerned, you cannot palpate the apex. You cannot feel the accentuation of either of the sounds; there is no great amount of overactivity. Overactivity is usually a sign of cardiac dilatation. On percussing the heart the apex is not beyond the nipple line, but just inside it. On auscultating, there are no murmurs at the apex, and the heart-sounds are approximately normal. The pulmonic second is somewhat or slightly accentuated but not sufficiently.

The reason the prognosis in this case is not good is because his pulmonic second is not properly accentuated, although he is being well stimulated. He is getting $\frac{1}{30}$ grain of strychnin every three hours, and yet his response to stimulation is not very good. His blood-pressure is not good; it has oscillated on both sides of the originally recorded pressure of 122—it has been as high as 152 and as low as 114. His statement, just made to us, that he would not go to any more meetings may be in accordance with the actual facts as they are going to turn out.[1]

His respiratory rate was 56 during the night.

In his case, instead of having a well accented pulmonic second sound and a blood-pressure which is greater than the pulse-

[1] The patient, though seemingly rational, yet thought he was at some meeting, and in his delirium said that he would not attend any more of them.

rate, we have a pulmonic second only very slightly accented and a blood-pressure which is less than the pulse-rate. The only cheerful point is the absence of arhythmia. What do these facts mean so far as the prognosis in this man's case is concerned? They mean that he is on the ragged edge of getting well; they indicate very bad prognostic signs, although the third is not present. If the third, or arhythmia, shows up today or to-morrow he will certainly not get well. If he goes along without any arhythmia then he may get well. The fact that he is twenty-eight will help him very much. The low leukocyte count is not in his favor; it would be better if it were higher.

You see, then, that in a case of pneumonia the important thing is the myocardium; it is not so much the lung. He has plenty of room to breathe; he is oxygenating his blood fairly well. His nails are not cyanotic; if they become so he will surely die. I might add the cyanotic finger-nails as a fourth prognostic sign.

As far as the lung is concerned he is not in any danger at all—the danger comes from the toxemia. The toxemia is neutralized in pneumonia as it is not in most diseases. The toxemia is neutralized at the time of the crisis when the patient breaks out into perspiration, chlorids begin to appear in the urine, and the patient is very much better. This crisis takes place anywhere from the eighth to the twelfth day; I have seen it occur in a child as early as the third day. The average is probably the ninth day. After the crisis there comes a post-clinical rise of temperature, perhaps to 101° F.; there may be just enough trouble added to result fatally. I remember one case particularly well where the patient died after the crisis, during the post-critical rise. Occasionally the myocardium becomes so toxic that after the crisis patients die of paralysis of the heart and comparatively suddenly. I remember the case of a physician who was supposed to be well of his pneumonia, so that his friends who were very solicitous about his recovery thought he was entirely out of danger, but he suddenly died of heart failure due to acute toxic myocarditis. Usually this condition can be foretold if one pays special attention to the examination of the heart, but if one does not the pneumonia case may deal a surprise.

Treatment.—In the treatment of pneumonia the only essential is to keep the heart beating. If you can do this the patient will get well, because pneumonia by itself alone does not kill. The thing to do, then, is to watch the pulmonic second hour by hour, to look for signs of cardiac dilatation, and to make certain that none occur. As the case goes along in the early stages not very much cardiac stimulation is necessary. It is wise to reserve your ammunition until the enemy approaches. If you begin stimulation too early, when the time comes for real work you can't do much. It is not our practice to give much stimulation until it is actually needed, and then we begin with strychnin. If the patient's heart seems not to respond to fairly large doses—$\frac{1}{30}$ grain every four hours or three hours—then we use digitalis. This you can give with immense benefit. If we are unable to stimulate the heart with the infusion of digitalis, our last resort is aromatic spirits of ammonia.

One of the two patients, whom I alluded to as recovering even after showing arhythmia, an old lady seventy-three years of age, was kept alive with aromatic spirits of ammonia. This should be given in water, 20 minims in a teaspoonful of water every twenty minutes, or at the rate of a minim a minute, and should be continued for several hours. We have had several very bad cases of pneumonia which, had it not been for the aromatic spirits of ammonia, would not have recovered.

Now sometimes you want something more urgent than strychnin, digitalis, and aromatic spirits of ammonia, which are given by mouth. Then you make use of camphorated oil or ether; one barrelful, or 15 to 20 minims, of ether just after or just before the crisis may sometimes tide the patient over. I remember very well a young girl who developed double lobar pneumonia, whose life was saved as surely by ether hypodermically as if she had been pulled out of the water and saved from drowning. So much for the treatment of pneumonia as to drugs.

As to the *care of the patient.* In private families the ill-instructed often want you to paste a whole lot of material upon the chest. It doesn't do any good. The popular idea dates back to the time when poultices were the fashion in pneumonia. All the

poultices you can put upon the outside of the chest will not have the slightest effect upon the underlying lung, because there is a space between the chest wall and the lung. No fluid can be extracted through that pleural space; no relief can take place by using poultices. Yet old people will want you to use some external application; don't do it. They may want you to use what is sometimes called Denver mud. If you place it all over the thorax, how are you going to listen to the lung through your stethoscope? All preparations of this type do not do one particle of good; they can abstract water only from the surface of the body. The mud and glycerin can't affect the underlying lung any more than if they were put on the leg. It would really be much better to put them on the leg, for then they would not interfere with the daily examination of the chest. Don't use these things in cases of pneumonia. Save them for inflamed joints or for places where poultices might be of value.

However, we do use the pneumonia jacket, the theory being that it prevents the chilling of the patient's body. It is not needed if the patient is kept in a warm bed, but it is needed in almost all cases at the present time for another purpose. The modern treatment is to give the patients all the fresh air that you possibly can. They should be kept in a room with wide-open windows. This is rather hard on the nurse, but fine for the patient. The patient gets along very much better by the open air method. This patient felt very uncomfortable when he was here[1] because the air was so warm; he wanted to go back upstairs. The patients know the difference between fresh air and somewhat stale hot air.

This practically constitutes the ordinary treatment of cases of pneumonia. The treatment is more a matter of day-by-day management, particularly of the heart, rather than the following of any set rules. The treatment resolves into just one thing: If you can keep the patient's heart beating until the crisis is over the patient will get well in the majority of cases. If you let the heart get ahead of you the patient is likely to die from acute dilatation.

[1] He had been sent back to the ward meanwhile.

Is there any way to get the best of the toxemia, to lessen the toxemia, in these cases? Yes, to some extent, but not to a great extent. One of the ways is to be sure that the kidneys act as well as they can be made to work, and the next is to make the skin do all the work it can, but this is difficult, as the skin is hot and dry; yet if the patient shows a tendency to perspire, that tendency should be encouraged as much as possible. Then, third, the bowels should be kept open and free. We sometimes add a fourth, and that is normal salt solution, in a continuous saline enema by the drop method. If patients are given plenty of normal salt by the drop method per rectum it is found that the kidneys will excrete more and the toxins can be washed out to some extent.

Can the toxins in the body be neutralized by antitoxins? Unfortunately, they cannot. There has been nothing found so far that has much effect on the toxins of pneumonia. Pneumonia is much like diphtheria in respect to its toxic action, but it has been found possible to get an antitoxin in diphtheria, though no antitoxins have so far been discovered for pneumonia.

To my mind, the use of vaccines has been entirely without result. The introduction of several millions of dead cocci into the body for the purpose of hastening the death of the remaining living ones seems to me foolish, for several millions are dying all the time, and what is the use of putting several more millions into the patient? We have tried these vaccines out, but have not found one of any value. Personally, I doubt if we ever will. If the disease is to be eradicated it will have to be by means of some immunizing body. When this is found then we shall have a cure for pneumonia which will be just as spectacular as antitoxin is in the treatment of diphtheria.

NOTE (May 19, 1915).—The patient had a normal crisis on the eleventh day, and a short post-critical rise of temperature, which two days later fell to normal. After this he went on to complete recovery, and left the hospital perfectly restored to health.

SYMPTOMS DUE TO ADHESIONS FOLLOWING AN OLD APPENDICITIS. LOCALIZING THE CONSTRICTING BAND. (OPERATIVE NOTES.)

THE patient is a comparatively healthy looking girl, whose history I will read and amplify, because all case histories need amplification. She is unmarried, twenty-two years of age. Her father, mother, and two brothers are living and well. She lost a sister, who died at the age of ten years. This sister was taken ill with diphtheria and died ten months later from endocarditis. We may be sure of one thing in this connection: the diphtheria was not the cause of the endocarditis. Diphtheria is a surface disease, spreading over mucous membranes, whether of the nose, mouth, pharynx, larynx, or elsewhere; it never gets *into* the depths of underlying tissue. It never invades the blood-stream or lymph-current. It is always a toxemia, frequently a very malignant toxemia, but it is never a bacteriemia. Hence, diphtheria of itself never can give rise to endocarditis, meningitis, pleurisy, pericarditis, or peritonitis. It can, of course, cause a toxic myocarditis, and frequently does so, producing death suddenly by paralysis of the heart. This toxemia produces degenerative changes in the myocardium requiring usually three or four weeks for their maximum development. Hence it is that death from the only possible cardiac complication in pure diphtheria—namely, a toxic degeneration of the myocardium or a toxic neuritis of the cardiac nerve supply—takes place during convalescence from the disease.

Where, then, did the endocarditis come from in this case? From a mixed infection. Frequently diphtheria is associated with streptococcic infection of the tonsils, and occasionally with infection by the *Streptococcus viridans*, the streptococcus of malignant endocarditis. When I was a medical student I got it into my head, largely from imperfect instruction in details of pathogenesis, that the bacteria floating in the blood-stream attacked the valves from their surface. In some hazy way I conceived of the bacteria as finding lodgment upon the valve edges and going to work upon their mission of ulceration and distortion. Of

course, that is all wrong. The way they begin their nefarious work is by passing through the coronary arteries and their finer branches until they find their way into the interior of the valve —almost always the mitral. Here they begin their work, usually just beneath the auricular instead of the ventricular surface of the valve, and usually nearer the point of attachment of the flap than the free edge. The first effect is a patch of inflammatory tissue beneath the surface. It quickly breaks through to the surface and so produces an ulcerative endocarditis. Then comes the war between destruction and regeneration; the breaking down of diseased tissue and its building up—ulceration and scar tissue formation with distortion of the valve. Hence it is that leaking always precedes narrowing. The leaking (or mitral insufficiency) comes first because the valves do not hold; and the narrowing (or mitral stenosis) comes only after scar-tissue formation or repair has been started. That is why in an acute endocarditis the first murmur heard is the systolic. The diastolic or presystolic murmur of a narrowing can appear only when scar-tissue formation or attempts at repair have begun.

I think it likely, in the case of this patient's sister, that the diphtheritic infection was associated with a streptococcic infection therefore, and that the latter, in view of her early death, was the cause of a malignant endocarditis. The whole process lasted only about ten months, and it is quite characteristic of the *Streptococcus viridans* to run a course of this length. It is evident that that child's history has no bearing on this girl's case. There is no history of tuberculosis or carcinoma in the girl's family.

Previous Illnesses.—She had measles and mumps when a child; she also had whooping-cough at the age of five, and scarlet fever at the age of ten. This caused a great deal of trouble to her, as it often does to many children. The things that we fear are nephritis and otitis media, and this latter complication she had in the left ear. It unfortunately affected her hearing, which has remained slightly impaired until recently, when she had her turbinates operated upon, with good results.

Present Illness.—I place the onset of her present illness at the age of thirteen. At that time she was taken sick with what was

called "ptomain poisoning." She and other members of the family ate some canned peas and she became sick afterward, but the other members of the family did not become sick. Let me say one thing about ptomain poisoning: When a person has ptomain poisoning he does not have a fever; he has, on the contrary, abdominal pain, cold sweats, vomiting, diarrhea, and a subnormal temperature, just as he does after poisoning with a drug of the depressing type. When a patient tells you that he is poisoned and you find that he has a fever you may be sure that he is suffering from an infection—not a poisoning. For example, at the present time there is in the hospital a woman from northern Michigan who two years ago, after eating some chicken in a dining-car on her way to Palm Beach, was suddenly taken extremely ill. On her arrival there a physician was called and said "ptomain poisoning." A daughter, who ate some of the chicken with her, had no symptoms of any sort, but the physician explained this away by saying that the mother ate more than the daughter. The case was really a gall-stone attack and she was operated upon here for purulent cholecystitis four weeks ago. The seizure two years ago was her first biliary attack. Keep as far away as you can from the diagnosis of ptomain poisoning in such cases. Never make the diagnosis unless you are absolutely driven to do so after exhausting all other possible diagnoses.

Here is another case that might possibly puzzle many physicians: a doctor, his wife, and three children ate some canned peaches at a Sunday evening meal, of the pick-up variety (the maid as usual leaving after the Sunday dinner), and they *all* became sick. The doctor said they had ptomain poisoning and I agreed to that because none of them had fever, and they all had vomiting and diarrhea, but by Wednesday the boy, who had the same abdominal pain that all the other members of the family had had, and who did not recover promptly as did the others, developed fever and was brought into the hospital. Here it was found that he had a leukocyte count of about 20,000. Without going into further details, I concluded that he was suffering from appendicitis and within an hour his gangrenous appendix had been removed by Dr. John B. Murphy. Had we not been careful

in our analysis, and had we not realized the diagnostic value of fever and infection, he might have gone on being treated for ptomain poisoning till he died. I have seen surprisingly few cases of ptomain poisoning; I have seen a large number of cases of alleged ptomain poisoning, but very few which could be definitely diagnosticated as such.

As to this girl's ptomain poisoning, the intern wisely writes down: "At the age of thirteen she had something which was called ptomain poisoning." We found on examination as to the details that this alleged ptomain poisoning was associated with fever, that she was sick in bed for three weeks, that she vomited only at the beginning, as a patient ill with appendicitis does, and that the vomiting then ceased; whereas, in true ptomain posioning the vomiting is excessive, continues for some time, and is associated with no fever. Furthermore, the patient had some sort of a relapse and was in bed off and on for nearly three months. One feels certain that if she had been examined very carefully and a blood count had been made to determine whether she had a leukocytosis at that time, one would have been found, that a diagnosis of acute appendicitis would have been made, that she would have been operated upon, and that her whole life history would have been changed. But nothing was done; she was allowed to get well as best she could, and she has been in poor health ever since.

Three years after this alleged ptomain poisoning she had a series of attacks which for the first time were diagnosticated as chronic appendicitis. This went on until she was twenty years of age and the appendix was then removed. We find on questioning her that on the removal of the appendix any number of adhesions were found, just as we might well expect from her history. Indeed, it was very difficult to get the appendix out, and after its removal she was very little better off than before the operation because the adhesions to which the appendix gave rise were not carefully investigated and released. As a matter of fact, it turned out to be a rather long appendix and it was removed with very great difficulty. The surgeon stated that he did not make any attempts to break up the adhesions because it took him so long to get the appendix out.

Resuming her history, we learn that she had typhoid fever at the age of nineteen, that she was sick seven weeks and had no complications. I questioned her carefully as to this illness and learned that it probably was typhoid fever, but no Widal test was ever made and no white blood-count—an unpardonable error—for a physician in even the smallest village nowadays can send blood somewhere for an examination as to the Widal reaction, and every medical graduate should be able to make a white blood-count and have the facilities for making it.

November, 1913, a year and a half ago, the patient was operated for appendicitis. A year later she had her frontal sinuses drained, with good results, and she has had her turbinates operated on, with marked benefit to her hearing.

The patient began to menstruate at the age of twelve years and menstruated fairly regularly for seven years; then her periods became irregular. On five or six occasions since the age of fifteen the patient has missed menstruating for two or three months at a time. The next menses after a period of three months would show greater quantities of blood than normal. The patient has always had marked dysmenorrhea. She says that she has menstruated regularly for the last four months, soiling four or five napkins a day for five days.

The patient first noticed disturbance in her stomach after eating the canned peas in June, 1906. Her history is interesting in that it also contains the story of three or four chills, indicating some sort of a chronic infection with exacerbations. There is also a complaint of rheumatism in the right knee without any apparent cause, and the presence of boils, both of which facts also indicate a focus of infection somewhere in the body. In addition to these complaints, she has had trouble with her stomach of a degree so severe that for nine years she has not tasted meat. She is now on a diet consisting of tea and coffee in moderate amounts, poached eggs on toast, oatmeal gruel, white meat of chicken, asparagus on toast, and sometimes she eats a little ice cream; she takes no milk because it nauseates her, and she will not eat anything in the preparation of which milk has been used. She actually eats nothing but the things enumerated, and she

vomits regularly—usually vomiting bile. There is evidently the constant presence of bile in her stomach; this acts as an emetic, as it always does, and hence she vomits. She is also very much constipated.

This disturbance of the stomach is subjectively not so much of a pain as it is a distress. It is not related to the taking of food; food makes her neither better nor worse. The disturbance comes on three or four hours or any time after a meal, just as it happens. There is clearly no reason for suspecting a duodenal or a gastric ulcer in her case, although the diagnosis of duodenal ulcer has been made by an Eastern physician. In a duodenal ulcer case we never find signs of infection, such as rheumatism of a knee or boils; there are never any chills, never any rheumatic pains. We would, of course, expect epigastric or gastric pain in ulcer, and we would expect it to begin one hour or two hours after meals. Moreover, in duodenal ulcer we would expect the pain to be relieved after the taking of food, but these symptoms she has not had. She has some infectious process about her, and this may have been associated with her appendix which was removed in November, 1913.

Ever since the patient was fourteen years of age she has had stomach attacks, which are really nothing more than temporary and severe exacerbations of her chronic gastric distress. Sometimes she has a sensation of distress located beneath the sternum at the right costal margin and passing straight back to the vertebral column. Sometimes a pain radiates from the epigastrium through the abdomen and around to the right side of the back.

Physical Examination.—On examining this patient she showed nothing but a very excellent scar from her appendix operation. She showed no tenderness in the epigastrium and no tenderness over the duodenal area. She is not of normal weight because she has starved herself for six years. We gave her a test-meal and found an absolutely normal gastric juice. There was no blood present and no lactic acid. The free and combined acids were absolutely normal in amount. There was no occult blood in the feces—a fact that has some bearing on the presence or absence of duodenal ulcer. Because of the persistent vomiting of bile we

were forced to the conclusion that some reflex phenomenon, undoubtedly due to disturbance of the normal relations of the peritoneum or else to its disease, was causing antiperistalsis. Thus, by reversal of the peristaltic wave, bile was being swept into the stomach daily, and daily it caused nausea and vomiting, just as it always does when it flows into the stomach. Such vomiting is always reflex, in my experience, being brought about most frequently by involvement of the peritoneum in the upper abdomen, less frequently by involvement of the peritoneum lower down.

Aside from the negative laboratory findings, the physical findings are also quite negative. There was more than the usual amount of abdominal distention, and on deep pressure there was some soreness rather than tenderness in the right side from the costal border to the region of the cecum. The blood examination was negative, there being a hemoglobin percentage of 90 and the normal number of red and white blood corpuscles.

Diagnosis.—The main factors demanding consideration are the history of the attack when the patient was twelve or thirteen years of age, called ptomain poisoning; the recurrent attacks of appendicitis beginning at her sixteenth year; the removal of her appendix when she was nineteen or twenty; the story that the appendix was hard to remove, and that, in view of the time spent upon it, no attention was given to possible adhesions; the daily vomiting of bile; the abstinence from meat and milk and almost all foods except half a dozen or so for a period of nine years; the reduced body weight; the constipation; the abdominal distention; and the soreness in the right side. To these symptoms must be added for consideration the normal gastric juice and the absence of occult blood in the feces, three tests having been made on three consecutive days. Concerning the *x*-ray plate I shall speak later.

Of all of these factors the most spectacular is the daily vomiting of bile, sometimes once, sometimes two or three times. When an appendix becomes involved the patient usually vomits but once, very likely because of an initial peritonitic irritation or shock. There is in appendicitis the usual history of pain all over the abdomen, then the patient gets a severe attack of

vomiting, next the temperature begins to rise quite moderately, an increased leukocyte count appears, and about twelve hours after the onset the patient for the first time experiences the localization of the pain in the right iliac fossa. In other words, an appendix of itself alone never leads to the sweeping of bile into the stomach day after day by a reversal of the peristaltic duodenal wave, and so to the production of daily vomiting and reflex disturbance of digestion. Some hypothesis other than a chronic appendicitis is necessary to explain the symptomatology. Hence, it is not strange that when her appendix was removed two years ago the vomiting, for which the operation was really done, kept on as before and she was in no way benefited. And hence it is that something else must be sought for to explain her symptoms, and presumably some peritoneal disturbance in the upper half of the patient's abdomen.

For we cannot charge the symptomatology to the stomach. The stomach in these cases is universally accused by the patients and was accused by this patient, but it is guiltless; it is simply doing its best to get rid of the bile, and this it does by the only method at its disposal—rejecting its contents. And, of course, the presence of bile in the stomach gives rise to a set of gastric symptoms other than vomiting, notably distress, nausea, extreme discomfort, a feeling of the presence of gas, and a desire to belch. It does not give rise to pain, but it does give rise to what the patient calls "intense indigestion." From these considerations and from the negative gastric analyses we are safe in concluding that the stomach is not at fault. We must look elsewhere.

Is the duodenum to blame? Remember that in this patient's case a diagnosis of duodenal ulcer has been made. There are two symptoms extremely suggestive of duodenal ulcer: pain two or three hours after eating, and the relief of that pain by eating again. The duodenal ulcer is painfully squeezed when the pylorus is contracted. With the opening of the pylorus by the ingestion of more food and the relief of pyloric tenesmus (if I may use that word in this connection for it so exactly expresses my meaning) the pain disappears. These symptoms the patient does not have. She really does not complain of pain in relation to

her food or of any pain at all. She merely has dyspepsia, nervous dyspepsia as it used to be called, with soreness on pressure in her right side rather than even a tenderness; and there is one other differential sign of great value clinically—the vomiting. A patient with a duodenal ulcer never vomits because of the ulcer alone. If the ulcer in time produces an involvement of the peritoneum, either as a periduodenitis, pericholecystitis, or both, then vomiting may appear. But vomiting in an uncomplicated case of duodenal ulcer does not occur. These clinical facts alone serve to make untenable the diagnosis of duodenal ulcer, and when correlated with a normal acidity in the gastric analysis instead of the hyperacidity in 80 per cent. of duodenal ulcer cases, and the negative findings as to occult blood in the feces, still further increase the presumption against the diagnosis of duodenal ulcer. Neither is there any involvement of the pylorus in cicatricial tissue. For we must believe that the pylorus is wide open because it is so easy for bile to make its way back into the stomach. There can be no very marked closure of the pylorus, then, either spastic or cicatricial, due to adhesions. Our whole conclusion is that a duodenal ulcer is not present.

Again reverting to our main proposition, we must conclude that the persistent vomiting of bile is due to some disturbance in her upper abdomen which is connected with the soreness on pressure in her right side, and which reflexly leads to antiperistalsis. Can there be an infection of the biliary tract?

In this connection there is another element in her history which might aid in settling that question, and that is the occurrence of three or four chills two years or so ago. The patient and her mother are not very definite as to these chills. They will neither affirm nor deny the presence of fever, though they both declare that the attacks were of short duration, the whole seizure lasting less than a day. There is a type of chill which occurs in connection with biliary tract infections associated with a sudden elevation of temperature and an almost immediate drop, so that instead of calling the record a fever-curve it should be called a fever-angle. This type of temperature with or without chills occurs in cholangitis, pylephlebitis, and in pus in the common duct

or neck of the gall-bladder where the lymphatics are so rich that immediate infection of the blood-stream can take place. Is it possible that the patient had such an infection? Our answer must be in the negative. A pylephlebitis results fatally; a cholangitis shows a long period of sepsis and usually there is icterus; and infection of the common duct or neck of the gall-bladder sufficient to cause such chills would not spontaneously disappear. These patients keep on being sick till the pus is found and drained. We have a patient in the hospital at the present time who had a little stone in the neck of the gall-bladder at the very entrance into the cystic duct. The diagnosis of his malady was made chiefly upon the history of three chills and sudden seizures of fever, as suddenly disappearing. Within an hour's time it was possible in his case to make a perfectly hard-and-fast diagnosis of biliary infection at the neck of the gall-bladder because he described these chills and the sudden and excessively transitory febrile attacks so graphically. On a certain day at half-past eleven he had a chill at his place of business. He went home and was in bed within an hour with a temperature of 103° F. By the middle of the afternoon he felt somewhat better, and by evening he and his wife went to a theatre in accordance with their plans made earlier in the week, tickets having been bought. The next day this man went about his business just as usual. That kind of a chill and fever is extremely characteristic of biliary tract infections. Another of these individuals whom I saw and on whom the same diagnosis was made, largely on account of these attacks of chills and transitory and high fever, was a woman who had such an attack at about half-past ten in the forenoon; at half-past two in the afternoon her maid telephoned me that the patient's temperature was 102.5° F. I could not get to her home until half past six that evening, at which time I found her temperature to be absolutely normal. Indeed, she seemed quite recovered. That patient had a small stone with a very small amount of pus in the very neck of the gall-bladder.

This patient gives a history which does little more than call such cases to mind. She herself is hazy as to the presence of fever. Gall-bladder cases and biliary tract infections, as a rule,

come from one of three things: typhoid fever, which the patient has had; appendicitis, which the patient has had; and duodenal ulcer, which she has not had. These three things are the great etiologic factors in biliary tract infections, save the accidents and infections of pregnancy. If, therefore, we are right and she had at thirteen years a severe attack of appendicitis, it is perfectly evident that she might have had as a sequel a disturbance in her biliary tract. But as against this possibility is the absence of a single clinical sign at present pointing to that diagnosis and the absence of all physical signs. There is no icterus, no tenderness over the gall-bladder area, no history of colic attacks, no signs of systemic infection except her knee. And her age raises a presumption against biliary tract infection, for it rarely occurs in the very young, especially at the age of thirteen or fourteen years. As far as this patient is concerned, then, we feel that she has no present disturbance of the gall-bladder; but we do not wish to seem dogmatic, and we, therefore, admit that in times past she may have had a pericholecystitis secondary to her appendicitis.

In order that we might arrive at a more definite conclusion as to the cause of her present trouble we had some *x*-ray pictures taken. For this purpose we gave bismuth and buttermilk twenty-four hours before we took the picture, and then another dose of bismuth and buttermilk five hours before the picture was to be taken. In this picture, which shows the bismuth taken twenty-four hours before, you will notice there is not so much left in the stomach, but here (indicating) is some of the five-hour bismuth, and this mass down in the sigmoid is both twenty-four-hour and five-hour bismuth. Having made these pictures, the patient was next given some more bismuth and buttermilk, and then, as soon as possible, another picture was taken. This does not show any abnormality of the stomach and no filling defects; the most noticeable thing about it is the absence of the duodenal cap. If the duodenal cap is absent it suggests a pathologic condition. It does not always mean duodenal ulcer when it is absent. We interpret it this way: if there is a good duodenal cap there is probably no duodenal ulcer or disturbance at the pylorus. If it

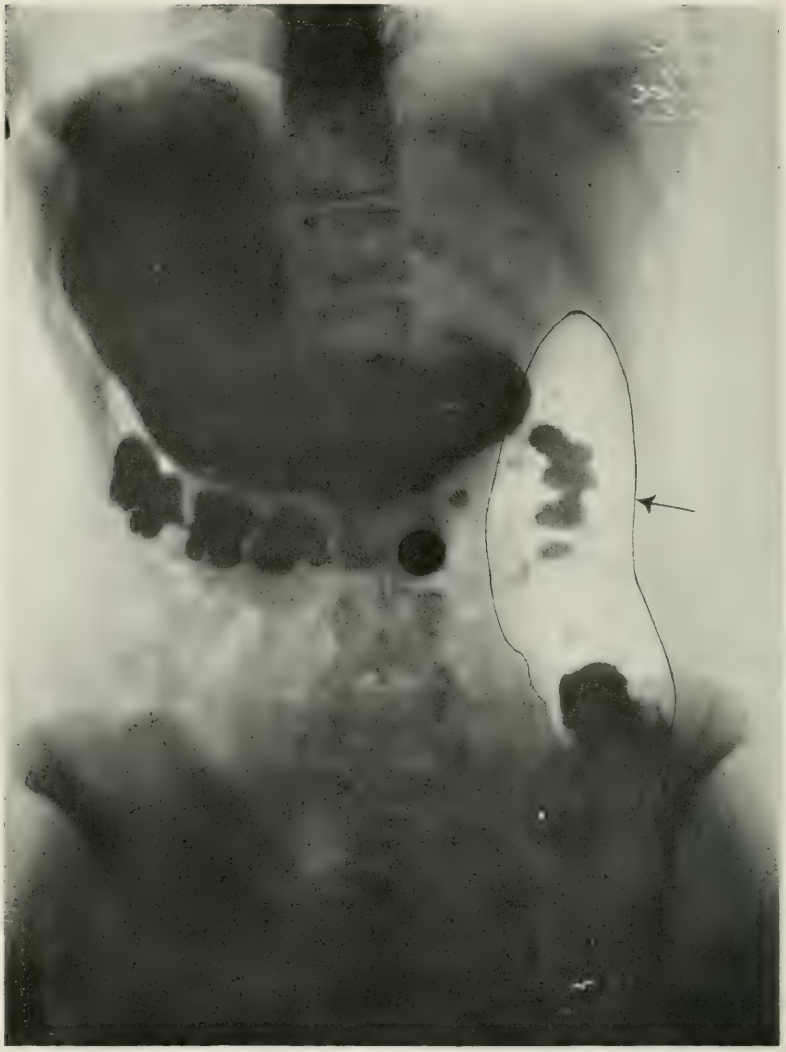


Fig. 121.—Skiagram showing dilatation of the ascending colon due to a narrowing from a band of adhesion at the hepatic flexure of the colon. Note the mass of bismuth in the beginning of the transverse colon showing through the terminal portion of the ascending colon. This shows that the dilatation of the colon ceases at the hepatic flexure.

is absent there may be a duodenal ulcer or some disturbance in the stomach.

In this second plate the noteworthy observation is the great width of the ascending colon, as high as the hepatic flexure. I do not regard this bismuth here (indicating) as being in the ascending colon, but I believe it to be in the descending portion of the transverse colon just below the hepatic flexure. It is evident, then, that after leaving the hepatic flexure the colon at once resumes its normal diameter. What is the meaning of this? What is there that could lead to a damming up of the gas in the ascending portion of the colon? The only thing which could lead to it is a band of adhesions at the hepatic flexure of the colon, and a pericholecystitis secondary to an appendicitis at some time past could very well have given rise to an affair of this kind. Is not that the actual state of affairs?

Indeed, we believe that in this case there is nothing at fault other than a band of adhesion following the primary attack of appendicitis at the age of thirteen, and called ptomain poisoning; and this has led to two things: a disturbance of a mechanical nature and also a narrowing of the hepatic flexure of the colon so that gas does not readily pass from the ascending to the transverse colon. So we have here a very excellent case for the science of diagnosis. *We must learn that it is by no means necessary to diagnose disturbances of the abdomen as diseases with names. The diagnosis is often merely the determination of anatomic conditions consequent upon healed-up disease.*

Treatment.—All the medicine we can give her will not do the least bit of good. The only thing that can do any good is a surgical operation which will release the hepatic flexure. That can be done; bad adhesions can be removed and the colon can be put back into a good anatomic relationship. When that is done the patient will be well. She can eat anything she wants; it may take the stomach some time to get over its bad habits, but after a time she will be all right. This patient is, therefore, to be operated upon, and by the next clinic we shall probably be able to tell you what was found.

Further Notes on Case, June 1, 1915.—I want to report on the case I told you about a week ago, the girl whose trouble apparently began with appendicitis when she was thirteen, which

was diagnosed as ptomain poisoning, giving rise to many symptoms clinically, among them chronic appendicitis, and the removal of her appendix when she was twenty. You will remember that the case was not regarded as trouble with the stomach or gall-bladder, but as a set of adhesions partly blocking the ascending colon at the hepatic flexure and causing delay in the passage of contents through the colon.

The laparotomy, which was done by Dr. John B. Murphy, disclosed exactly what we thought was present. There was no ulcer in the stomach at all. The cardiac opening and lesser curvature were explored thoroughly. The duodenum was rather large, but showed no sign of ulcer. On the other hand, the transverse colon almost exactly at the hepatic colon was narrowed by adhesions. These adhesions were pathologic; they were red and inflamed, and they bound down and partly constricted the second inch of the transverse colon. It was that which led to the big dilatation of the ascending colon which you will remember showed in the *x*-ray plate a good deal of shadow where the gas was dammed back.

The girl vomited from the effects of the operation for only a few hours and since that time she has not vomited at all. You will remember that she was vomiting bile daily before the operation, and it is very comforting to think that she has not vomited any since. Great care was taken that no new adhesions might form. Both cut ends of the adhesive band were tied off and the colon was wrapped up with the omentum, so that there cannot be any future adhesions to cause more trouble.

NOTE: June 15, 1915. The patient made an uneventful convalescence, and when she left the hospital weighed only 5 pounds less than when she entered it, notwithstanding the operation which she had gone through. She is eating chicken, lamb chops, and beefsteak, drinks milk freely and eats things in the preparation of which milk has been used. In every respect she appears perfectly well and she feels well.

CLINIC OF DR. RALPH C. HAMILL

COOK COUNTY HOSPITAL

TIC DOULOUREUX: INJECTION OF THE GASSERIAN GANGLION; TECHNIC OF OPERATION

THIS patient is suffering from a disease which, though extremely painful, often to a degree entirely incapacitating for work, is not dangerous to life. The disease is interesting, both because of its comparative rarity, as seen in the County Hospital, and because of the therapy.

It is difficult to get a good history because of the patient's inability to talk or understand English, and because efforts at translation are mostly unsuccessful on account of his volubility, he being a tempermental Italian. The following facts, however, seem fairly well established. They were gleaned from him at the time of his entrance into the hospital on the 6th of September.

He is thirty-seven years of age, a laborer, married. There seems to be nothing in his family history of particular interest. His wife and three children are living and well. In the history of previous diseases rheumatism is spoken of, but it is impossible to obtain a good description. However, rheumatism, arthritis, neuralgic headaches, migraine, are all of interest in the etiologic consideration of this man's sickness. He does not drink, smokes a little, uses no drugs.

He came into the hospital complaining of pain in the left side of the face, running from the inner canthus of the eye down into the left upper bicuspids; he first had this pain about ten years ago; since that time it has recurred in attacks lasting a week or two, coming every five to ten minutes, with periods of freedom for one to two months. For the past three years, however, he has had pain practically every week, though only

at periods has it been sufficiently severe to prevent his working. Last December he had a severe attack and again a month before he entered the hospital. The last attack began sixteen days before admission. The pain is described as a lightning-like jab of tearing, wrenching, stabbing pain, coming on with full intensity, lasting from a few moments to three minutes, during which time, though the severe pain is constantly present, the excruciating jabs recur every couple of seconds. As soon as this paroxysm of pain subsides he is fairly comfortable until the next occurs. Some days, he says, he would have a paroxysm every few minutes; on other days only two or three during the course of the twenty-four hours. During these periods of a week or two of painful attacks any movement of the face or any sensory stimulus to the left side of the face was apt to bring on pain. Swallowing, talking, chewing, shaving, etc., would all precipitate a paroxysm. Though the pain originally ran only from the inner canthus of the left eye down into the left upper jaw, in more recent attacks, and especially after the attack has persisted for a few days, the pain, although starting in this circumscribed region, will rapidly spread and involve the whole left side of the face, from above the hair line down through the left cheek into the left side of the upper and lower jaws, though it has never been experienced in the left half of the tongue. He had three teeth withdrawn soon after the beginning of these pains without any particular influence on the course of the trouble. At no time has he had any profuse discharge from the nose; he is not particularly susceptible to colds; the pain in the face is not associated with nausea or vomiting.

The neurologic examination is negative; the reflexes are normal; sensory examination is normal. Blood-pressure is 130 systolic, 90 diastolic. The heart and arteries are normal; the urine is normal; spinal fluid was normal.

There is no difficulty in arriving at a diagnosis. The pain is characteristic of but one condition, and that is tic douloureux, or trifacial neuralgia. Similar pain might be caused by pressure or irritation of the Gasserian ganglion (the sensory ganglion of the fifth nerve) by a tumor or by an arteriosclerotic condition, but if

it were a tumor one would expect to find some change revealed by the neurologic examination—some difference in the reflexes, some paralysis, especially oculomotor, possibly some change in the optic nerve, or some evidence of increased intracranial pressure, such as headaches, vomiting, etc. The fact that the disease has lasted ten years fairly well rules out such a tumor process. The normal condition of the heart, blood-vessels, and urine rules out arteriosclerosis.

Tic douloureux is a well-known clinical condition for which no adequate pathology has ever been demonstrated. The etiology is unknown, though, as I said, rheumatoid conditions including migraine seem to have some etiologic significance. Impacted molar teeth and infections of the sinuses of the skull are undoubted factors in some cases. Sinus examination and *x*-rays eliminate these two conditions in this patient. These tearing, shooting, throbbing pains are characteristic of the pain of tic douloureux. Where such pain is due to some local condition, such as a sinus infection, it is practically always accompanied by a dull, continuous pain as well, a thing that this man has never had. I cannot too strongly emphasize the fact that between his paroxysms of pain he was entirely free from suffering.

The therapy of this condition is a most varied and voluminous one. All sorts of drugs have been tried, the only one having any particular effect other than that of a mere sedative is castor oil. This has to be given in large doses daily, combined with rest in bed, so as to avoid as much as possible the cathartic effects. It is usually given in a one-half to two-ounce dose, t. i. d., for a period of weeks. Of course morphin will give relief, but it is most unwise to use morphin in this condition.

Of the surgical means, cutting of the nerves, surgical removal of the ganglion, injection of destructive substances into the nerves at various places and into the ganglion have been used. I will pass over the injection of substances other than that used in this case because of their inferiority.

Five days after this man entered the hospital I injected 20 minims of an 85 per cent. alcohol solution into the infra-orbital foramen of the left side. This was followed by a complete anal-

gesia in the distribution of the infra-orbital nerve; the relief from the pains lasting, however, only two days. The pain then returned as severely as ever. Four days later I injected the same strength of alcohol directly into the Gasserian ganglion, since when (five weeks ago) he has been entirely free from pain.

We will describe this injection in detail. The solution used for the injection of the branches of the fifth nerve in this case was that recommended by Dr. Hugh T. Patrick: alcohol

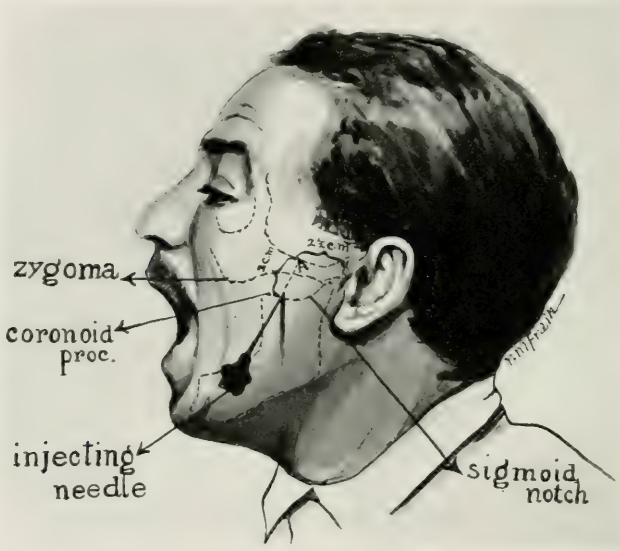


Fig. 122.—Injection of the Gasserian ganglion. Position of the needle A, portion of the needle, running from the surface of the cheek to where it approaches the foramen ovale, indicated by dotted line.

$3\frac{1}{2}$ drams, cocain 1 grain, water to $\frac{1}{2}$ ounce. I used a needle 1.1 mm. in diameter, 7 cm. in length, having a butt fitting a Luer syringe. Before connecting the syringe the needle is inserted at a point 2 cm. below the zygoma and $2\frac{1}{2}$ cm. anterior to the external auditory meatus (Fig. 122). When a puncture is made at this point it is necessary to have the patient open his mouth as widely as possible. The needle is pointed upward, at an angle of about sixty degrees to the plane of the

face, and slightly back, passing above the notch of the lower jaw. At slightly more than 4 cm. bone is encountered, the pterygoid plate; this is followed up to where it joins the floor of the skull. That is, the needle is slightly withdrawn, the direction changed so that it points a little higher, reinserted, withdrawn, the direction changed, etc., until one feels that from the bone running in the sagittal plane of the head one has encountered bone running in the horizontal plane. After assuring oneself that the base of the skull has been reached, the same proceeding of withdrawing and reinserting is followed, the point being directed more and more backward. As the edge of the pterygoid plate is reached and passed one enters the immediate neighborhood of the foramen ovale, through which emerges the third or inferior branch of the fifth nerve, and immediately above which lies the Gasserian ganglion in Meckel's space at the inner anterior edge of the petrous portion of the temporal bone. It is necessary at this stage to assure oneself that the point of the needle is on the base of the skull, lateral to the foramen ovale. The point is then inclined slightly downward and advanced, whereupon—if in the right place—a sudden pain is felt in the distribution of one of the branches of the fifth nerve, most commonly the third; namely, in the lower jaw, cheek, lip or tongue. The needle is then advanced about $\frac{1}{2}$ cm., when pain should be felt in the other branches of the fifth nerve. The syringe is then connected to the needle, a few drops of the alcohol mixture are injected, and the patient ordinarily complains of a sensation in the face as if thousands of little darts or needles had shot through the corresponding side of the face. When one is assured by this sign that he is in the right neighborhood, $\frac{1}{2}$ to $\frac{3}{4}$ c.c. can be injected, whereupon analgesia appears throughout the distribution of the fifth nerve. Such an analgesia you see is present in this patient. (See Fig. 123).

The danger in this operation lies in inserting the needle too far, when one may penetrate the cavernous sinus; or, if one is not in the foramen ovale and the needle is inserted too far, there is a possibility of striking one of the large blood-vessels at its point of entrance into or exit from the skull just behind and

internal to the foramen ovale. To avoid such accidents the guides I have spoken of—namely, the pterygoid plate and the base of the skull—must be followed accurately. The needle had best be marked at centimeter intervals, for it is dangerous to go more than 5 cm. deep.

Following the operation there is danger of development of a corneal ulcer; such an ulcer has developed in this patient. I

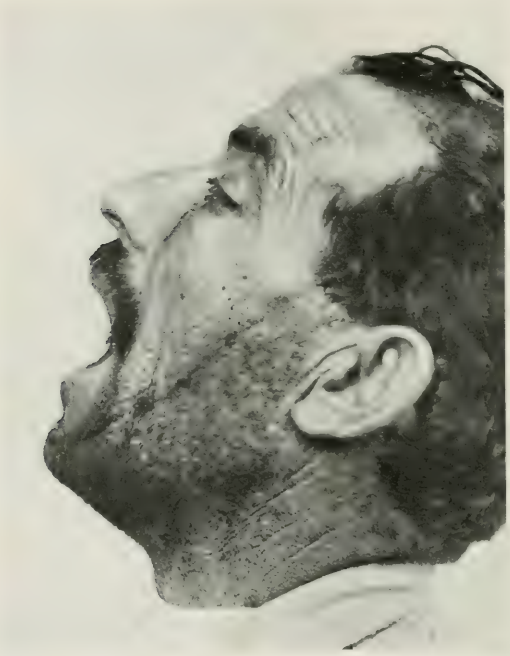


Fig. 123.—Position of lower jaw to allow of low insertion of needle. Line running down cheek marks posterior line of anesthesia.

believe it is due partly to the fact that his eye was not covered and kept closed during the first twenty-four hours following the injection. Since that time a shield has been kept over his eye, but I believe it would be a still better plan to have the lids securely fastened together. Some men even go to the point of suturing the lids together. Dr. Halstead meets the same indication after destruction of the Gasserian ganglion in an open opera-

tion by filling the palpebral fissure with sterile vaselin, and then applying the eye bandage. This he repeats daily.

Dr. W. Harris, of London, recommends a method for determining the exact amount of solution to be injected. He injects a few drops, then tests the sensibility of the forehead with a dull pin to determine the presence or absence of analgesia; in case the few drops have not produced the analgesia he waits two minutes, tests again, injects a few more drops, waits two minutes, and so on, until he gets an analgesia but not a total anesthesia. By stopping short of total anesthesia he expects to escape the danger of corneal ulceration, and he considers the good effects as lasting as where there is total anesthesia.

The injection of the ganglion was done in this patient rather than further peripheral injections, such as I will describe, because the peripheral injections have to be repeated on an average of every nine months, perhaps as long as the man lives. Peripheral injections are to be recommended in the old, where expectancy of life is not, as it is in this man, many years. These peripheral injections can be made at the foramina of exit of the three branches of the nerve, namely, the supra-orbital foramen about $\frac{3}{4}$ cm. out from the inner end of the eyebrow, the needle pointing slightly upward and outward; or into the infra-orbital foramen for the second branch, entered best $\frac{1}{2}$ cm. laterally and $\frac{1}{2}$ cm. upward from the ala nasi, the needle pointed upward and outward, and can be inserted into the foramen for a distance of 2 to $2\frac{1}{2}$ cm.; or into the mental foramen for the third branch, going in 4 cm. to the side of the median line and 1 cm. above the inferior border of the lower jaw; the needle is pointed practically straight back toward the occiput.

In case these superficial injections do not produce the desired analgesia and relief from pain, injections may be made into the second and third branches at their exit from the skull cavity. The second is reached in the pterygomaxillary fossa shortly after its exit from the foramen rotundum. The point of entrance is preferably $\frac{1}{2}$ to 1 cm. posterior to a perpendicular dropped from the orbital ridge of the zygoma at a point just behind the malar prominence. The needle is directed slightly upward and slightly

backward. Bone is encountered at a depth of about 4 cm., the needle is withdrawn slightly, pointed a little upward and reinserted, the process being repeated until the point of the needle slips past the bone when it is in the immediate neighborhood of the middle branch. Alcohol is injected, the position of the point changed slightly, more of the solution injected, until complete analgesia is obtained in the distribution of this branch.

The so-called deep injection of the third branch is made in practically the same locality as that traversed in entering the foramen ovale, only in this case it is not necessary to start the puncture more than just below the lower border of the zygoma. In this procedure, as in the ganglion injection, the pterygoid plate is reached, though when this direct route is taken it is usually encountered at a depth of from $3\frac{1}{2}$ to 4 cm. The same process of withdrawal and changing the direction and reinsertion is practised until the point of the needle slips past the bone, when pain may be felt in the peripheral distribution of this inferior branch, or such pain may be felt only upon injection of alcohol at a depth of from 4 to $4\frac{1}{2}$ cm. In some cases no peripheral pain is experienced and the only guide or sign that the nerve has been reached consists in the finding of analgesia in the distribution of the third branch.

These procedures would be quite simple were it not for the fact that there are anomalies in the bony structure of the floor of the skull, bulging of the malar prominence, anomalies of the zygoma, of the mandibular notch, etc. It may be very difficult to reach the middle branch because the opening in the pterygomaxillary fossa is too narrow, it may be practically impossible to reach the inferior branch because of the fact that the foramen ovale may lie too close to, or even slightly inside of, the posterior border of the pterygoid process. In these cases the point of entrance or insertion of the needle may have to be altered, we may have to depend entirely upon peripheral injections, or the case may have to be treated by open operation.

Of all the methods of procedure, injection of the ganglion seems to be the best. It is attended with very little danger, the shock of opening the skull cavity and the danger of hemorrhage

in such an operation is avoided, and, if the ganglion is well injected, there is no danger of recurrence of the trouble. If, after an apparent success, the pain returns, and a partial return of sensation is found in the distribution corresponding to the pain, then reinjection should be attempted.

A CONDITION RESEMBLING LANDRY'S PARALYSIS IN A SYPHILITIC. PECULIAR SELECTION OF THE MOTOR CRANIAL NERVES. DIFFERENTIAL DIAGNOSIS. MARKED IMPROVEMENT UNDER VIGOROUS ANTI-SYPHILITIC TREATMENT

THIS patient is an example of a very unusual form of involvement of the central nervous system. He entered the hospital on the 18th of September, presenting much the appearance he shows now after six weeks. About five days before his entrance he noticed that he was unable to articulate well; his voice became hoarse. At about the same time his eyelids began to droop, it became more and more difficult for him to raise them until on admission to the hospital he had a complete ptosis—a complete drooping of the upper lids. His hands and feet became numb and weak he says. It seems that the hands and feet were first involved and then the thighs and shoulders weakened. His hearing seemed to be somewhat impaired, his tongue felt thick and stiff, and he had some involuntary passages from the bowels.

In his previous history several points of importance were elicited. He had gonorrhea several times, a chancre five or six years ago, with practically no treatment and no secondaries. During the past year or two he has been drinking immoderately, using as much as 1 pint or even 1 quart of whisky a day. He is twenty-six years of age, has been married four years; several times his wife has skipped two or three weeks in her menstrual period and then flowed profusely. Also, there is the history of a three- or four-months' miscarriage. Otherwise the family history is negative.

A little more careful inquiry brings out the following: He was apparently well up to the time when he first noticed the hoarseness and difficulty in his speech. He has had difficulty in swallowing during the period of his illness; his vision did not seem distinct, there was a dull, steady headache over the temples and in the occipital region; there was some vertigo, and besides the involuntary defecation there was also some difficulty in controlling urination, which was more or less without sensation.

Fig. 124.—Showing relaxed condition of facial musculature. No movement was possible of the muscles of the face, including those of eyelids and levators of lower jaw.

Physical examination, a day or two after entrance, shows a well built, apparently healthy young man who is suffering no particular discomfort except a dryness of the mouth and throat, due to the fact that he cannot close his mouth well. He takes very little nourishment because of his inability to swallow. When left alone the lower jaw droops, the mouth hangs open, the cheeks are perfectly flat and without wrinkles, the eyelids droop, and the forehead is almost without wrinkles. As he tries

to speak there is practically no movement of the face. Articulation is very indistinct—palatals, labials, linguals are all practically indistinguishable, only the vowel sounds are really distinct—yet it is possible to understand his speech.

Examining the cranial nerves, one finds that he seems to smell fairly well, vision is normally acute, and he hears fairly well. He is unable to raise the eyelids, in fact, unable to move them at

Fig. 125.—Showing eyeballs with lids raised. No movement of eyeballs was possible. At the time these pictures were taken the pupillary inequality had disappeared.

all. When the eyelids are raised you see that the eyes are immobile in the middle position, staring straight ahead. The pupils are both slightly irregular in outline, the left 8 mm. in diameter, the right 4 mm. There is almost no reaction of the left pupil either to direct light, to accommodation, or consensually; the right reacts to direct light, to accommodation, and consensually, but all these reactions are sluggish and of small amplitude. The eyeballs are absolutely immobile in the sockets—not

the slightest suggestion of movement. He is unable to move any muscle of the face or any of the muscles used in chewing; that is, there is complete paralysis of the motor-root of the fifth nerve and of the seventh. There is difficulty in swallowing; the soft palate hangs well forward in the mouth and low. There is paralysis of the uvula. He protrudes the tongue, but seems to have very little force behind it; it is extended practically in the middle line. There is no paralysis of either upper or lower extremities, but some of the muscle groups of the thigh, especially the anterior group and the gluteal group, are somewhat weakened. The grip is of fair strength; there is no marked inco-ordination. The corneal and conjunctival reflexes are recorded as present; the palatal reflex is absent, the triceps absent, the biceps and wrist present, the abdominals absent; the left knee-jerk is obtained only upon reinforcement, and that but slight; the right knee-jerk is fairly normal. The Achilles reflexes are normal, the plantar reflexes normal, sensation relatively normal. The optic nerves show no marked deviations from normal, a slight redness of the disks being present, but whether of a pathologic degree or not is questionable. The left hand and forearm show the atrophy of disuse. At the age of three his hand was cut across the palm just proximal to the metacarpophalangeal articulation. This difference in the size of the two arms is probably due to the fact that he has never had good use of the left hand. Mentality is normal. There is slight bradycardia (54 beats to the minute), the pulse is regular, the heart normal.

A lumbar puncture done three days after his entrance showed fifty cells to the cubic centimeter; the Nonne and Ross-Jones tests were faintly positive; Wassermann test on blood and spinal fluid has been strongly positive on at least four different occasions, both in the laboratory here at the hospital and as done by Dr. F. G. Harris. Both the hospital and Dr. Harris reported that there was complete binding of the complement with $\frac{2}{10}$ c.c. of spinal fluid. In other words, the spinal fluid was markedly positive to the Wassermann test. The urine was negative on several different occasions.

A couple of days after entrance he complained that the numbness in his legs was growing worse and that his bowels had not moved for four days.

On the third day of hospital residence he was put upon 2 drams of mercurial inunction, with increasing doses of potassium iodid.

An interesting phenomenon seen during the first few days of his stay here was a positive Beevor sign in an inverse or reverse direction; that is, the umbilicus instead of remaining stationary when, with the arms crossed on the chest, the patient attempted to raise the head, moves fully ¾ inch downward and slightly toward the right. Normally in response to this test there is but little, if any, movement of the umbilicus. The movement seen in this case is due to a weakness of innervation of the upper halves of the recti abdominalis compared to that of the lower halves. In this patient the lower, having the stronger innervation, pull the umbilicus downward when they contract strongly during the effort to raise the head. This difference in innervation shows that for a short period of time the eleventh and twelfth dorsal segments, controlling the lower recti, were not involved to the same degree that the ninth and tenth, controlling the upper, were. At that time it was noticed that there was complete loss of abdominal reflex in the upper quadrants of the abdomen, with practically complete loss in the left lower quadrant and a faint reflex in the right lower quadrant. A couple of days later it disappeared, the abdominal reflex was again entirely absent, and the anal sphincter, over which he had regained some control, had again ceased proper function. Examination at this time revealed a loss of the anal reflex, and upon making a rectal examination the sphincter was felt to be relaxed, and just within the anal aperture was a large mass of feces such as would certainly produce a desire for defecation except in the absence of proper sensibility of the mucosa of the lower rectum.

On the 22d (four days after entrance) he was given 0.9 dram of neosalvarsan intravenously; the following day it was noticed that the left pupil had come down to about the size of the right, that the triceps reflex had returned in the right arm, that swal-

lowing had improved somewhat, and that he could move the lower jaw a little better; but at the same time the knee-jerks had entirely disappeared, the legs seemed to be weaker than at the time of entrance, and the arms also were somewhat weakened. Tubal feeding had been necessary from the time of entrance; when the patient wished to swallow he had to hold his lower jaw up with his hand and make great effort.

A week after entrance he ceased to have involuntary urination, though he said there was no sensation during urination. On the 26th he received another 0.9 dram of neosalvarsan intravenously, and on that day it was noticed that the left pupil reacted about as well as the right. With this improvement in the cranial nerves there was an increase of disability in the lower extremities, especially the right. There was almost no strength against passive movements. The Achilles reflex remained throughout the course of the sickness. Eleven days after entrance a faint movement upward of the eyeballs was observed, better in the right eye than in the left. The speech was slightly improved, swallowing a little better, although he was able to swallow only a teaspoonful at a time; the drooling of saliva, which had been a marked symptom from the onset, had ceased, strength in the arms seemed better, and the biceps and triceps reflexes both could be elicited. The left leg was a little stronger than the right; there was almost no resistance to passive movements demonstrable in the right leg; there was slight tenderness over the supra-orbital, infra-orbital, and mental foramina. Taste was unimpaired over the tongue, using quinin, sugar, salt and glacial acetic acid solution.

On October 1st the left abdominal reflexes were more brisk, the right normal. Examination at this time showed that when the lower eyelids were pulled down with the finger there was very little tonicity. The Achilles reflex seemed somewhat feeble on the left side; as before, there was no knee-jerk, no cremasteric, and no anal reflex. Dr. E. V. L. Brown reported on the 2d of October that the disks were normal.

On October 5th he was given 0.9 more neosalvarsan intravenously. Since that time he has had several intraspinous

injections of mercurialized serum, mercurial inunctions have been continued, and now there is considerable improvement. The eyeballs show fair movement, he is able to raise the lids, there is considerable movement in the left side of the face. An electric examination done about a week ago showed a well-marked reaction of degeneration in all the muscles of the face.

To summarize the symptomatology, we have an involvement of the motor cranial nerves, coming on rapidly and reaching its climax within a period of a day or two. That is, there is involvement of the third nerve on either side which is practically complete; all functions of the third nerve are abolished, except that in the right pupil there was at the time of examination a slight reaction to light.

The fourth nerve was also completely paralyzed, as was the sixth; there were no movements whatsoever of the eyeballs in any direction at the time of entrance to the hospital.

The motor division of the fifth nerve was also completely paralyzed, or at least almost so. There was very little, if any, movement of the soft palate; there were practically no movements of the muscles of mastication.

There was complete paralysis of the seventh nerve on either side.

The sensory cranial nerves seem to have entirely escaped. The twelfth nerve on either side was only slightly involved; he could protrude the tongue and move it in all directions, but the action was rather weak.

Movements of the head dependent upon activity of the sternocleidomastoid muscles seemed to be practically normal. In other words, the spinal accessory, the eleventh cranial nerve, had practically escaped. There was a slight bradycardia. He could make vocal or laryngeal sounds fairly well; consequently, we can assume at least partial functioning of the tenth nerve.

There was a paresis if not a paralysis of the structures of the pharynx. When he entered the hospital he was practically unable to swallow; this probably implies an involvement of the ninth nerve, the glossopharyngeal. At the time of entrance, and, in fact, all the way through, the arms have been relatively free

from involvement. On the other hand, the abdominal muscles, the abdominal reflexes, the muscles of the thighs, the knee-jerks, and the sphincters have been markedly involved. All this without any marked involvement of the sensorium, with the exception perhaps of a diminution of sensation on the part of the rectal, bladder, and urethral mucosæ.

These motor symptoms and symptoms from the side of the reflexes were accompanied at one time or another by marked change in the electric reaction in the face. There was complete loss of response to the faradic current, very sluggish response to the galvanic. There was also a lymphocytosis when puncture was made five days after the onset. Subsequent punctures showed on an average twenty-five to thirty cells to the cubic millimeter. The Wassermann reaction has in all instances been strongly positive. The mentality has been entirely clear. At one time there was a headache, apparently somewhat relieved by the first lumbar puncture.

What disease is it that can cause or produce such a picture as this? There are various forms of disease of the central nervous system in which there is rapid spreading of the motor paralysis from one part or segment of the body to another. Acute poliomyelitis must first be considered. In acute poliomyelitis it is not uncommon to get a lymphocytosis in the spinal fluid. Acute poliomyelitis, however, rarely skips from a bulbar involvement to an involvement of the lower dorsal and the lumbar cord as it did in this case. Acute poliomyelitis in practically all instances reaches its climax in a very few hours and from then on the further course is marked by a gradual improvement of all but those groups of muscles most seriously involved. In this case the cranial nerves were involved in a few hours after the onset, but six or seven days after the onset the legs got much worse, the sphincters became more seriously involved, and there was a loss of the small remnant of abdominal reflex. In other words, the disease showed a wave-like tendency of progression and recession. The increase in symptoms was not marked by any temperature rise, as one might expect in a poliomyelitis.

Another form of rapidly progressing motor involvement is

commonly referred to as Landry's paralysis. The typical Landry's paralysis, however, starts in the lower extremities and rapidly spreads in a continuous fashion from lower to higher segments. In this patient this continuity of progression was not observed and the disease began in the cranial nuclei, a beginning which, though not unknown in Landry's paralysis, is, neverthless, rare.

Acute ascending myelitis is a third disease which could produce a rapidly progressing motor involvement, but the motor paralysis is always associated with sensory paralysis as well.

Acute polyneuritis of the toxic nature could produce very similar motor symptoms to those seen in this case, but the motor paralysis would be associated with much more sensory disturbance than we have in this patient. There would be more tenderness of the extremities. The extremities of the limbs would be involved much more than the proximal segments in a polyneuritis, whereas in our patient movements of the calves and the peroneal group, as well as the Achilles reflexes, are preserved, while the strength is markedly diminished in the gluteals and in the extensors on the front of the thigh with a loss of the knee-jerks.

In this patient there is a frank history of syphilis, acquired five or six years ago. He took practically no treatment; his wife had several experiences suggestive of miscarriages, one of which is unquestioned. The Wassermann is strongly positive on both the blood and spinal fluid. Consequently, and especially in view of the spinal fluid Wassermann, I believe we are entirely justified in considering this condition due to syphilis. Syphilis of the basilar meninges is a very common form of expression of this protean disease. Usually, however, it is more chronic and not so wide-spread. The cranial nerves in this case, I believe, were involved by a basilar syphilitic meningitis, which in all probability included or invaded the substance of the midbrain along the course of the motor roots. So far as symptoms of the lower extremities are concerned, and those of the sphincters, I believe they are due to the meningomyelitis. This is borne out by the appearance of a Babinski sign on the left side—evidence that the process had involved the pyramidal tract on that side.

Going on the assumption that we had to do with a syphilitic nervous disease, this man has been given active antisyphilitic treatment. He has had intravenous neosalvarsan, mercurial inunctions, potassium iodid, and three intraspinous injections of mercurialized serum. That he has improved I think cannot be questioned. Therapeutically, then, our diagnosis seems to be borne out.

The prognosis is not unqualifiedly good, although I rather expect considerable improvement with further medication.

CLINIC OF DR. CHARLES SPENCER WILLIAMSON

Cook County Hospital

THREE CASES OF MALARIA

Blood Examination Absolutely Essential for Diagnosis and Important for Distinguishing Between Benign and Malignant Types. Technic for Examining Fresh Blood and Stained Specimens. Description of the Tertian, Quartan, and Estivo-autumnal Parasites. Disease Not Uncommon in Cooler Climates. Treatment by Intramuscular Injection Before Sporulation, if Possible. Indications for Oral and Intravenous Administration of Quinin. The Gamete Carrier a Public Health Problem.

Case I.—The first case I wish to present to you, gentlemen, is a boy aged nineteen, a native of America, and by occupation a baker. He came into the hospital with the following symptoms: First, chill; second, fever; third, sweats. Along with this he has had severe pain in the left side, a very intense backache, and, in addition, the somewhat unusual symptom of failing vision. The onset of the present trouble was six or seven days ago, with a dull headache, a good deal of malaise and constipation. He took three doses of salts for the latter trouble without getting any result. Five days ago, at about 11.30 in the morning, he had a severe chill, which lasted, he thinks, fully two hours. This was followed by a very hot feeling and later by a sweat. Simultaneously with the chill he had a sharp pain in the left side up under the ribs. This persisted up to the time he entered the hospital on the third. The day following the beginning of his sickness, at 1.30 p. m., he had another chill. This was repeated on Sunday, October 3d, the third day, at 10.30 a. m. So he had a chill on Friday at about 11.30 a. m., on Saturday at 1.30 p. m., and on Sunday at 10.30 a. m. On Sunday he also vomited about

a pint of undigested material. After entering the hospital he had a chill on Monday, but none on Tuesday.

The previous history is unimportant. He had measles at ten years of age. At three years he suffered an injury to the right eye (a jab with a stick), and now he says his eyes both seem to have a film over them.

This illness represents his third similar attack of chills and fever. The first occurred when he was thirteen, that is, six years ago, in Nashville, Tenn. It lasted about two weeks. The second attack occurred two years ago and also lasted about two weeks. Both of these attacks were exactly similar to the present one. During the last six years he has been right here in Chicago, and since his last attack, two years ago, has been perfectly well, showing no symptoms of any kind. He has not been out of Chicago for many months.

He denies venereal disease; his habits are good; the family history shows nothing of interest to us.

Physical Examination.—On admission, examination showed that he was well nourished, although of slight build; the head and neck were entirely negative, except for a scar on the left side of the head due to a furuncle several years ago. The mouth showed a marked herpes labialis; along with this he had a pyorrhea; otherwise, the head and neck were negative. There were no glandular enlargements. The chest showed nothing abnormal. The abdomen showed nothing particularly abnormal, except that the spleen was distinctly palpable and is still plainly to be felt, about two fingers' breadth below the costal arch. It is plump, and the edge is round and hard. There are no other abnormalities in the abdomen, no gurgling in the iliac fossæ. The extremities are normal; blood-pressure normal.

Now, to begin with, he shows very plainly the evidence of some acute infection—chills, fever, sweat, backache, pain in the left side—all these indicate some severe infection. The thing that one would most naturally think of as coming on suddenly with fever which ran up as high as 102.6° F., then down to normal, then up the next day and down to normal and up the third day, would be the so-called intermittent fever; namely, malaria. I

should think that would be the first thing one would think of. A chill at one hour one day, a little later the next day, and then

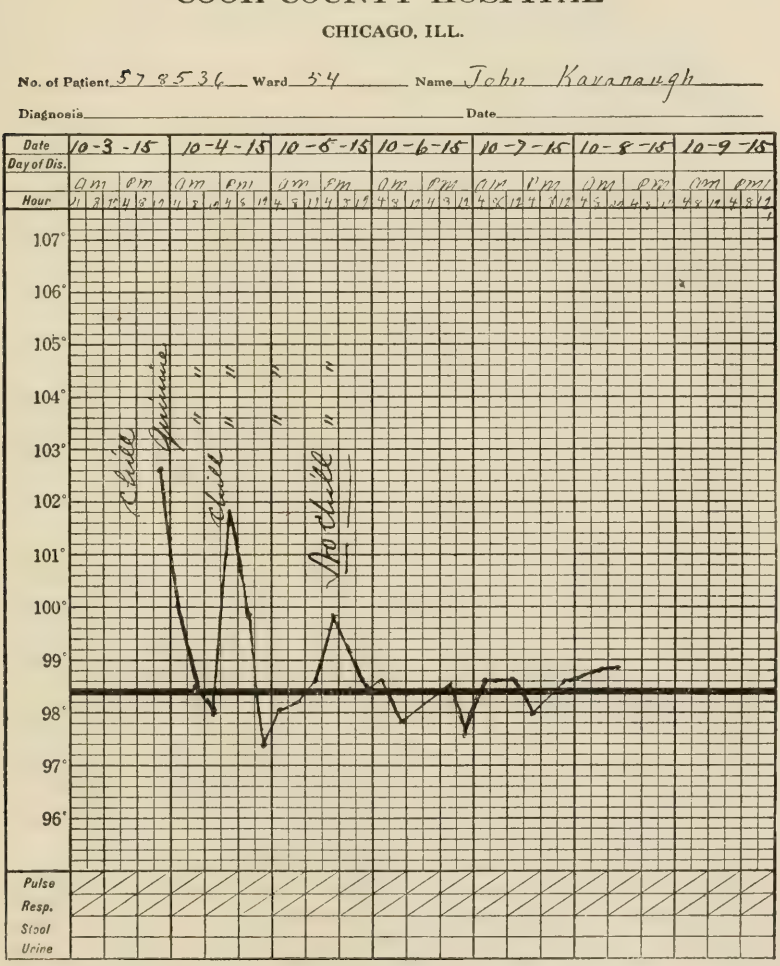


Fig. 126.—Double tertian (quotidian) malaria, showing the effects of treatment.

going back to practically the same time the following day, with the fever, that would be the most likely guess. Coupled with these chills and fever is the large spleen—a plump, hard spleen.

The edge is fairly well rounded and the organ gives the impression of being even larger than it really is. The blood examination showed 8000 leukocytes, and examination on entrance of a fresh blood film showed malarial parasites in great abundance, and of the tertian type. Moreover, we see parasites of all ages, indicating two groups, in other words, a double tertian or quotidian infection.

A very pretty problem presents itself in this case as to whether it represents a new infection or a lighting up of an old infection. To settle that question would be more or less a matter of speculation. The old physicians used to say that if malaria were once in the system it was difficult to eradicate. In highly malarious localities there is a strong tendency for the chills to recur in the spring and fall. There may be, however, a fallacy in that for as long as a patient remains in a malarious locality he is likely to be bitten by infected mosquitoes again. So one is never able to say with certainty whether the infection represents a lightning up of an old case or a new infection as long as the patient remains in the malarious locality.

This boy has been here all the time during the last six years, and has already had one previous attack of malaria here. Now I won't attempt to settle that question, except to say that it is just possible that he has been a malaria carrier all this time and that it has simply lighted up again. On the other hand, a new infection may have developed here. We do see cases of malaria in Chicago that seem to develop right here. I have seen in the last year a case in a highly intelligent young man living in Chicago all the time who early in June developed a most severe attack of the estivo-autumnal type; in spite of the most vigorous treatment he had another attack in the middle of the winter and was not out of the city in the meantime. Evidently I had not been able to eradicate all the parasites, for our winter climate of January and February is not favorable to mosquitoes. So it seems that we do have malaria which develops right here; in other words, there are mosquitoes in this region that will infect with the parasite of malaria.

It is still an unsettled matter as to just how relapses occur,

for they sometimes do occur in the most surprising way. It is customary to distinguish between short-term and long-term relapses. For relapses which develop within a few weeks of the original infection, one can readily comprehend that some parasites have remained in the blood, too few in number to produce symptoms, but when they have multiplied sufficiently chills and fever develop anew. One might suppose that some especially favorable conditions were necessary for multiplication. This view is adopted by Ross. For the relapses which occur after a longer interval, say some months, it would seem more reasonable to suppose, as Craig suggests, that there must be some resting form of parasite. Still another theory is that there may be developed in the blood, when the infection is improperly or insufficiently treated, strains of plasmodia which are quinin-fast, and the development and sporulation of these produce the recurrence.

As you will note, the diagnosis was made almost immediately on entering the hospital, and, although he had had his chill, quinin was given at once, and the best proof that it was effective is that two days later (on the 5th) the expected chill did not occur. Quinin was continued, and while the chill occurred on the 4th, due to the other group of organisms, it did not recur on the 6th. In other words, the group of parasites sporulating on Sunday, Tuesday, and Thursday was destroyed by the quinin given Sunday. This did not, however, affect the parasites sporulating on the intervening days. On Monday the quinin given killed off the Monday, Wednesday, and Friday group, and so, after the chills of Sunday and Monday, no further chills occurred.

There are two or three simple points that I want to impress upon you in regard to malaria. In the first place, there is one rule which you should rarely break; namely, *Do not make a diagnosis of malaria without finding the organism.* When a man comes to you with chills and fever, no matter how typical they may be, no matter how closely they may resemble the tertian or quotidian type, don't make the diagnosis of malaria without first finding the organism in the blood.

The second point to remember is that there are certain accessory features about the disease. Malaria is associated with a normal number or a diminution in the number of leukocytes. In this case we also have the herpes, which is very helpful in the diagnosis.

There are two ways in which the examination of the blood can be made—there is the stained specimen and the fresh specimen, and I am very greatly biased in favor of the fresh specimen. One simply takes a drop of blood from the ear, touches a cover glass to it, drops it gently on the slide and slips the specimen under a $\frac{1}{12}$ oil immersion, and one-half hour's search will usually show the parasite. Don't waste time looking at a poor specimen, but have the blood well spread in a single layer and you will almost surely find the parasite if you look at the right time. The very worst time is shortly before the chill or immediately after, since at this time the parasites accumulate in the internal organs. The very best time of all is five or six hours before a chill. So if a patient knows at about what time to expect a chill, take the specimen about five or six hours before. It is commonly stated that the parasites are a little less numerous in the fresh specimen, but it is very difficult for me to understand why, except that the small ring forms (estivo-autumnal) are hard to see in fresh specimens. If one takes a specimen and looks at it and then takes a second drop, and stains it and looks at it, why are there not just as many parasites in the fresh specimen as in the stained? I think it is due rather to poor miscroscopy. If you know anything about the microscope you can hardly make a mistake with the fresh specimen, that is, in the sense of confusing the malarial organism with artefacts, and therein, to my mind, is the great advantage of the fresh specimen.

In the next place, unless you are very expert and have a great deal of experience, never make a diagnosis from the small hyaline parasite alone. Just as soon as there is pigment in the parasite, just as soon as you see the little pigment granules moving around, you can make the diagnosis without fear of mistake. In an indifferently stained specimen even a fairly well-trained microscopist can make a mistake, but in a really well made Wright's

stain, where the chromatin is a good cherry red, a mistake can hardly be made.

Occasionally a blood-plaque or a bit of stain will lodge on top of an erythrocyte, and be deceptive, but the red chromatin is always distinctive. My advice is for you to hold fast to the fresh specimen, and a careful search ought to give you the diagnosis without much difficulty. If you are not expert with the microscope, it may be easier for you to find the parasite in stained films, but my choice is always the fresh blood. There are certain cases where the diagnosis is especially difficult; for example, where the patient has been given quinin. If a patient has taken a very few grains of quinin for a day or two it may take a long search to find the parasite in the peripheral blood.

There is a good deal of talk about the so-called therapeutic test. A man will say "I know that case was malaria because he got well when I gave him quinin." The mere fact that you gave a man quinin and he got well does not prove that it was a case of malaria. It is a very bad habit for a man to get into, to make his diagnosis by the result of treatment. Never make a diagnosis in any such way if it can possibly be avoided. You may be pretty sure if a man comes from a malarial district that it is malaria which he has, but never make a positive diagnosis until you examine the blood. The first thing to do is to find out when the chill is due. If you see him at a time within three or four hours before the chill is expected, examine the blood at once. If you do not find the parasite then, examine it again and again and you will almost surely find it. It is almost entirely a matter of patience and repeated examinations. This applies especially to the tertian type, which we see here, most frequently. In the estivo-autumnal type it is occasionally extraordinarily difficult to find. You may search for several hours before finding it, but patient search will almost invariably repay you.

I know of but one instance where a doctor should delay the blood examination for treatment, and that is in malarial coma. In cases of that sort one should not wait for the demonstration of the parasite to give quinin. If one can get any kind of a decent history, give the quinin first, but my rule is, unless a case is very

serious, demonstrate the parasite first. I remember a case in my intern days in another city, where we had large numbers of malarial cases, in which a patient came in just as my attending

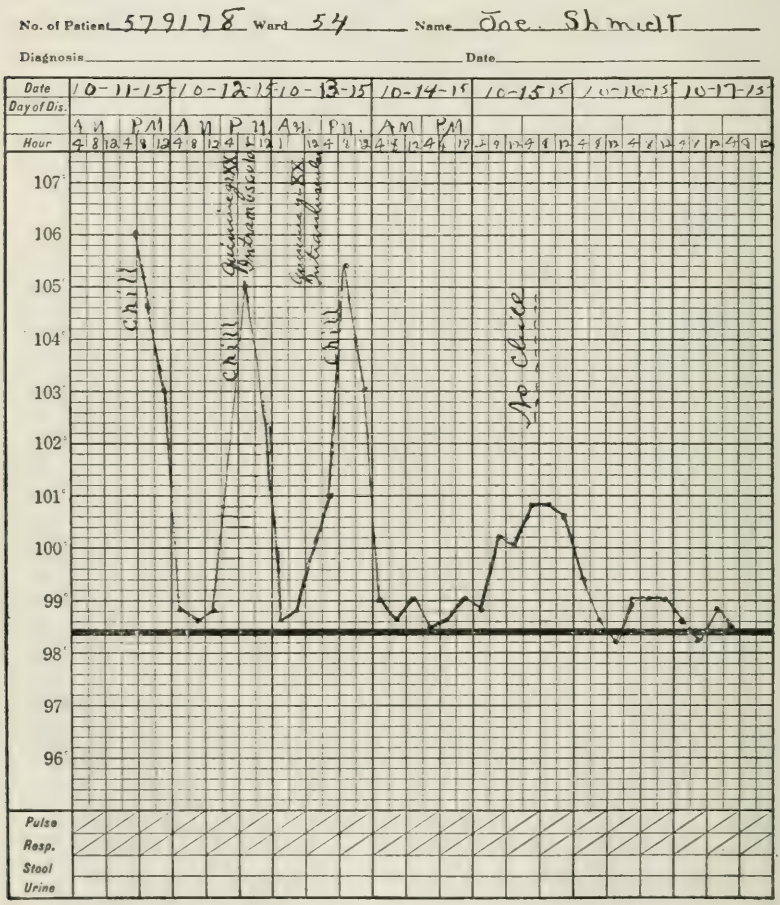


Fig. 127.—Malaria (double tertian type), showing the effect of treatment.

man was giving a clinic on malaria; and he took the patient down and showed him as a typical malaria just as we are showing this case to you. After the clinic we looked for the parasite, but

could not find it even after searching many, many times, and yet he was having typical quotidian chills. After running a course that looked as much like malaria as anything could, it turned

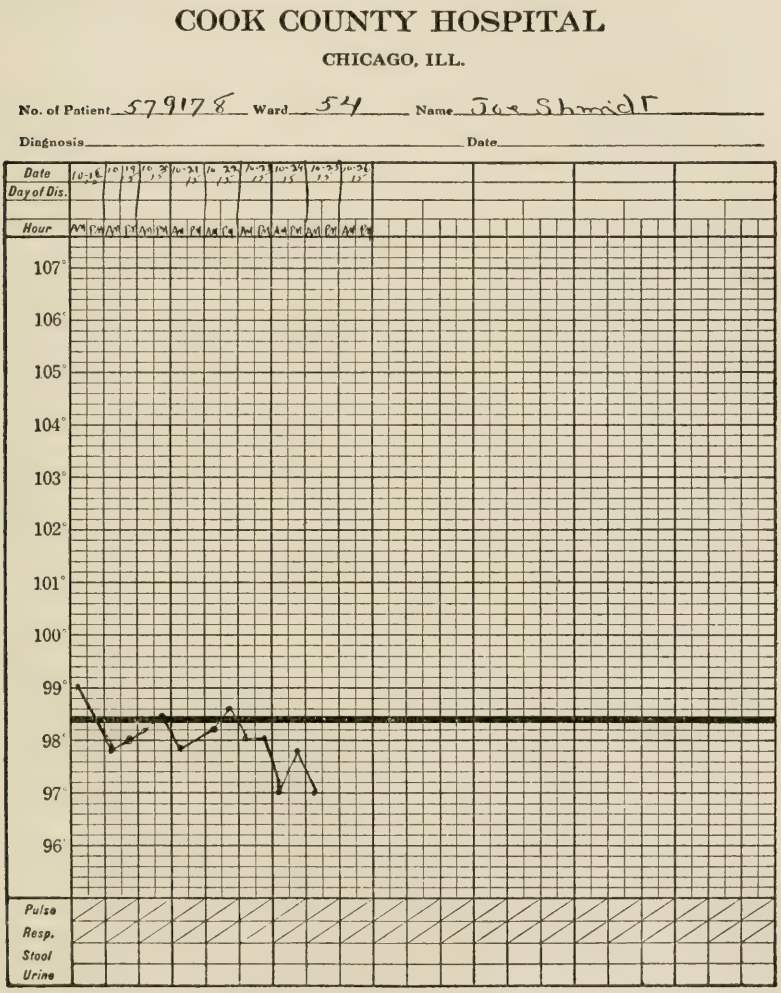


Fig. 128.—Continuation of Fig. 127.

out to be an influenzal pneumonia. This illustrates the risk of error in making the diagnosis of malaria without first finding the parasite. So I say to you that whenever you find a case that

simulates malaria, find the parasite before you institute any treatment, and then you know what you are doing and can proceed in an intelligent manner.

There are one or two tricks in the examination of malarial blood that will occasionally prove useful, especially where the parasites are scarce. A very satisfactory procedure is a method devised by Ruge, and that is, to take a slide, put a drop of blood on it and make a very thick smear, several times thicker than an ordinary smear, and then fix this in 5 per cent. formalin and 1 per cent. acetic acid. This dissolves out the hemoglobin and renders the specimen rather transparent. Then stain it with any of the Romanowsky stains, such as Wright's. This is a very satisfactory method when the parasites are difficult to find, and is also satisfactory if you wish to make show specimens, even when the parasites are easily found.

Another way is the Bass method, with which I have not had very much experience. Bass has a method of centrifuging the specimen, but I have not used it enough to be able to pass accurate judgment upon it.

A factor which tends to obscure the diagnosis in these cases is the belief that this locality is malaria-free. Chicago is quite a ways from being malaria-free. Of course we do not begin to see the number of cases one does in Cincinnati and farther south, but there are a sufficient number of them to keep us on our guard. Don't forget that a stranger may come in who is infected, and in that way spread it around, through the medium of the mosquitoes.

Case II.—The next patient is a Lithuanian, forty-five years of age. He complains first of chills, second of fever, third of sweats, fourth of headache, fifth of severe pain in his chest. This condition began four days ago (last Sunday) at about four o'clock P. M. He had just arrived in Chicago, coming in from a railroad camp about eighty-five miles from St. Louis. He was feeling weak and aching and was suddenly taken with a chill. He says the whole bed shook and it lasted for about an hour and a half. This was followed by a very hot feeling, which lasted for several hours, and then by severe sweating. These paroxysms have

occurred every day in the afternoon. He had one Sunday, Monday, and Tuesday afternoons.

When he came in the physical examination showed nothing particular. He is a big, strong, powerful man. Examination of the chest showed nothing to account for the pain; there was nothing about the abdomen to account for the pain except a rather slight enlargement of the spleen. His temperature since he came into the hospital has been extraordinarily characteristic. It was exactly 106° F. at four o'clock on Sunday afternoon; by twelve o'clock that night it dropped to 103° F., and by the following morning was down to 98.6° F.—a drop of over seven degrees during the night. This is a perfectly characteristic drop, and would make one think at once of malaria. The next day the temperature went up again with his chill and reached 106° F. by rectum. This is a very high temperature, so it is quite evident that he has a pretty severe infection.

A blood examination was made immediately upon his entrance to the hospital, but at that time no parasites were found. In the morning, however, six or eight hours before the next chill, the tertian parasite was found in fairly large numbers. This emphasizes a point which I have already mentioned, namely, the difficulty of finding the parasite near the time of the chill. This, strictly speaking, applies only to the single infections, since in the double infections at the time one group is sporulating and producing the chill the other group is just half-grown and should be readily found. The fault, then, for not finding the parasite at the first examination lay, probably, in insufficient examination rather than in the time of taking the blood. A moment's consideration makes it plain that no matter when the blood is examined in a double tertian infection, organisms of different ages will be found. This is characteristic of the double infections, and a diagnosis ought to be reached in most instances from the blood alone. This case is no exception in that respect. When the plasmodia were found it was evident that they could be divided roughly into two great groups sporulating on different days. Even if this were not clear from the examination of the blood, the history is so characteristic as to leave no doubt that

if the case is one of tertian malaria at all, it could only be a double infection, producing a quotidian fever. I wish to make this point perfectly plain. It is not safe to conclude that if a patient has chills, typical in character, recurring daily or every other day, that he has either a single or double infection with the tertian parasite (Plasmodium vivax), since, as I shall show you later, exactly this same thing can and does happen with estivo-autumnal infections. Of course, if one has found the tertian parasite in the blood, and the chart shows a chill recurring daily, it can only be a double tertian infection, or else possibly a mixed infection.

After settling the diagnosis of malaria in general, the next step is to make the diagnosis of the variety. As you all know, three varieties are recognized—first, the tertian; second, the quartan; and, third, the estivo-autumnal. Many observers divide the latter into two subvarieties, but, from a practical standpoint, the three varieties named will answer all purposes.

Diagnosis of the Type.—Now, gentlemen, it may seem to you that the diagnosis of the individual form of malarial infection is something of a refinement, and not really necessary from the practical standpoint. That is, however, far from being the fact. It is highly important to be able to say whether a given infection belongs to the benign tertian type or whether it is of the estivo-autumnal type, which is vastly more serious and furnishes the large majority of the cases of a severe character—the real pernicious forms. Now, it is often possible to make a probable differentiation of the type clinically if one can obtain a clean-cut and intelligent history, yet, on the other hand, *the clinical diagnosis of the type is never certain.* The only correct method is to base the diagnosis of the variety exclusively on the examination of the blood. In most instances this differential diagnosis is not difficult, and with increasing practice becomes fairly easy. There are a number of well-recognized differences between the three types of parasites and I will place the most important of these upon the blackboard.

The most striking peculiarity of the tertian parasite is the manner in which it produces enlargement of the corpuscles. The

infected red cell becomes much larger, often one and one-half times the normal size or even more. The cells are strikingly pale. When making an examination of the fresh blood film the large size and pallor of the infected corpuscles may be the features which call attention to them. This is true more especially of the older parasites (half-grown), for when very small the young hyaline forms affect the size of the red cells but little if any. Another peculiarity is, that this type of parasite fills practically the entire cell. Often in fresh specimens, especially if one is careless and examines with a poor light, the narrow rim of corpuscle surrounding the parasite may be entirely overlooked, although in stained specimens it is very plainly evident. The third striking feature is the marked ameboid movement of the parasite. It thrusts out pseudopods in such a way as at times to give the impression that there are two or three separate parasites in the same corpuscle, but a little further observation will show that there are fine bridges of tissue between them, much in the same way as fine bridges of nuclear tissue exist between the various lobes of the nucleus of the polymorphonuclear white cell. The outline of the parasite is hard to discern because of its slightly refractile nature. The pigment is in very fine granules that dance about at a lively rate. The cycle of the parasite is forty-eight hours in length, but its growth is much more rapid in the last twenty-four hours, and it attains its full growth at about forty hours. A useful diagnostic point is to be found in the location of the pigment, which at this stage is evenly distributed throughout the parasite, whereas in the quartan organism at this stage it is at the periphery, and in the estivo-autumnal at the center. The various stages of segmentation now begin, and here again the appearance is characteristic. The number of segments is generally from fifteen to twenty, and they are arranged somewhat irregularly and not in the beautiful rosette of the quartan form.

The principal characteristics of the quartan form (which type is very rare in Chicago) are its smaller size, the corpuscle being of normal size or even slightly smaller than normal, and its more highly refractile appearance. It is much less actively ameboid

and the pigment is coarser and much less active, and located at the periphery in the later stages. In segmenting, the pigment gathers at the middle, and a typical rosette, the so-called daisy or marguerite form, develops with only six to twelve segments. One can hardly mistake a quartan parasite in the presegmenting and segmenting stages, for the almost perfect geometric symmetry is highly characteristic.

The estivo-autumnal parasite is contained in a corpuscle of slightly smaller size than normal and often shows a brassy color. This plasmodium is highly refractile, has some ameboid movement, but not much, and the movements are slow. It is hyaline for the first twenty-four hours, developing a small quantity of pigment on the second day. The small amount of pigment is quite characteristic. The young parasite often takes on a signet ring appearance which, while not pathognomonic, is very typical. The parasite when full grown rarely fills more than half of the corpuscle. The segmentation of this form of parasite occurs almost exclusively in the internal organs, and is rarely found in the peripheral blood. The pathognomonic sign of the estivo-autumnal infection is the presence of crescents and ovoids, which are the sexual forms of the parasite, and which never develop in tertian or quartan infections. These forms do not, however, develop until the infection has lasted a few days.

In this case, as I said a moment ago, we found the tertian organism, and from the fact that parasites of all ages were found, we concluded that it is a double infection. Yesterday (the 12th) the patient had a chill, also one the day before, and the day before that, so that our diagnosis of a double tertian (quotidian) type from the blood is verified by the clinical history. The patient received one injection of quinin and urea hydrochlorid, 20 grains, deep in the buttock, during the chill yesterday. If he runs true to form he should have another chill this afternoon or early this evening, and in that event will receive a similar dose. We are practically certain that he will have a chill shortly, for we have just taken another drop of blood, and found the organism just about to segment.

NOTE.—The expected chill occurred about 4 P. M. that after-

noon, just after the close of the clinic, and the patient received the second injection of 20 grains of quinin and urea hydrochlorid. The first injection, on the 12th, prevented not only the

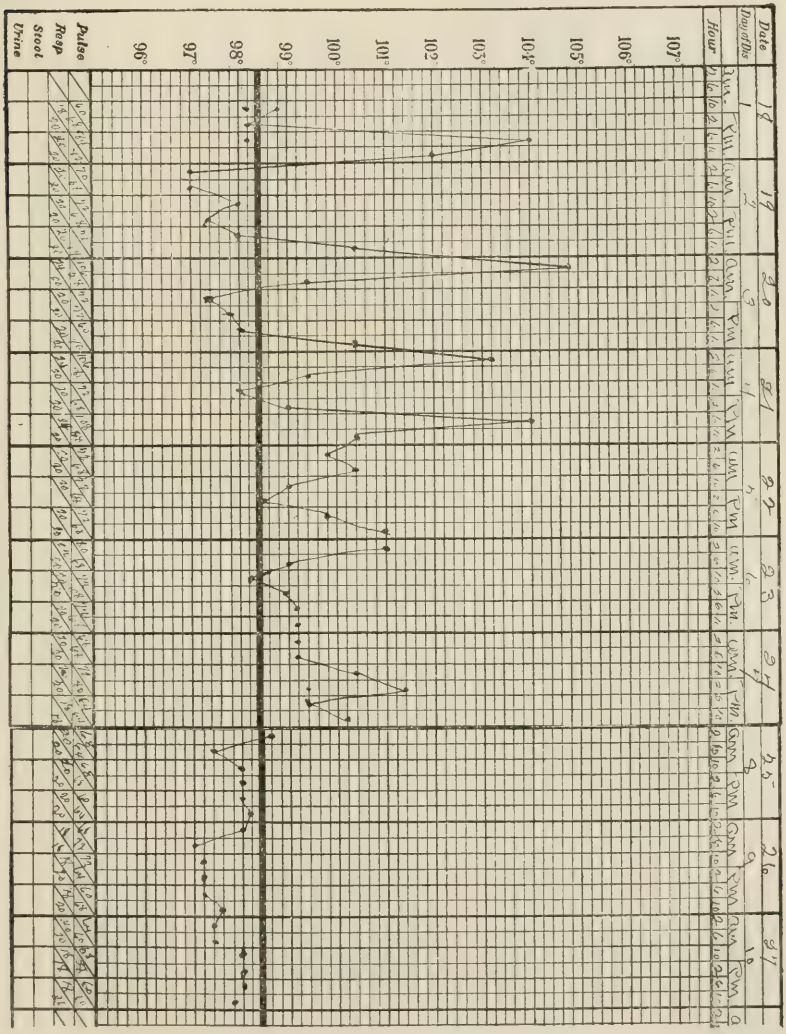


Fig. 129.—"Hepatic intermittent fever" simulating malarial fever.

chill, but any rise of temperature on the 14th. The injection on the 13th prevented a chill on the 15th, but there was a rise of temperature to 100.8° F. rectal. From that time on the tem-

perature has been normal or subnormal, the patient receiving quinin by mouth in small doses three times a day to destroy any organisms which might not have been killed by the two intramuscular injections.

There is one condition which sometimes simulates a malaria very closely, and that is the so-called hepatic-intermittent fever, associated with infections of the bile tract, especially of the finer radicles. The local conditions in the liver, often a jaundice, and the absence of the malarial parasite in the blood upon repeated examinations, makes the diagnosis clear. There is often a leukocytosis in the hepatic condition, and generally an absence of the splenic enlargement characteristic of malaria. The appended chart from a patient recently under my care in another institution will show the close similarity of the temperature curve in this condition to that of a tertian malaria. This patient showed also a high leukocytosis.

Case III.—*The Estivo-autumnal Type.*—This patient has been in the house for only two days. He is an Irishman, single, fifty-four years of age, and a railroader. He comes in complaining of chills recurring regularly, fever and sweats, headache, dizziness, anorexia, and weakness. Says he was working on the C. & E. I. Ry. until about two weeks ago. He first noticed a severe headache and anorexia; that evening he had a chill, a very severe one, lasting, he thinks, about eight hours. This was succeeded by a feeling of intense heat, in which the patient discarded all the bed covering. Following this he had a profuse sweat, severe headache, and felt weak. During the first week of his illness he had an attack like this every second night, and during the second week they occurred every night. The chills came on with great regularity every evening between seven and eight o'clock. During the day the patient felt very weak and had dizzy spells, his headache was pretty severe and appetite exceedingly poor; the bowels regular. There was no previous disease of any kind that bears upon the present. He says he was in the hospital once with dropsy and he had grip once. His personal history is negative; no gonorrhea, no lues; he drinks very little. Both parents died of old age.

Physical examination shows a strong, well-developed, powerful individual. The eyes, ears, nose, and throat are practically negative, except for a slight swelling of the tonsils. The neck, head, and lungs show nothing abnormal. The abdomen shows a normal contour, and there is nothing striking on inspection. I can just palpate the edge of the liver, about a finger's breadth or a little more below the costal arch in the right nipple line, and it feels soft and sharp. The spleen can be felt about a finger's breadth below the ribs, round and firm, but not very hard. The extremities show that the right ankle is somewhat edematous and that the right knee is ankylosed as the result of an old injury. This is the "dropsy" that he speaks of, and it has nothing to do with any cardiac or kidney condition. The urine shows nothing abnormal.

When we come to analyze the case now, we see that he entered the hospital in the evening with a temperature of 100° F.; the next morning the temperature was 96.8° F.; that was yesterday morning. It rose to 102.8° F. last evening, falling to 97.2° F. this morning, and at the present time (2.30 P. M.) it is only 98° F. and a fraction. The history of the illness dates back for a couple of weeks; at first he had a chill every second day, a hard, vigorous chill with fever and sweats following. Then the second week he had a chill every day, and now he says he can't be quite sure whether he has a chill or not, he is quite chilly all the time, but last night he was sweating all night. He comes from a place down in the state where malaria is pretty prevalent, and so our mind turns at once to malaria, especially when we find further that he has an enlargement of the spleen. If we are to speculate about the type, we have to say that he has not been in the house long enough for us to tell much about it by the temperature; but with a chill at first every other day and then every day we would think first of a single tertian, with later the development of a double tertian; in other words, at first an ordinary single infection and later another group of organisms becoming implanted and giving a double infection.

Examination of the blood showed that he has 3,100,000 reds and only 7000 whites, with low hemoglobin. That would speak

in favor of a malaria, and when we examined for the plasmodia we found them. We will make a fresh specimen and examine it

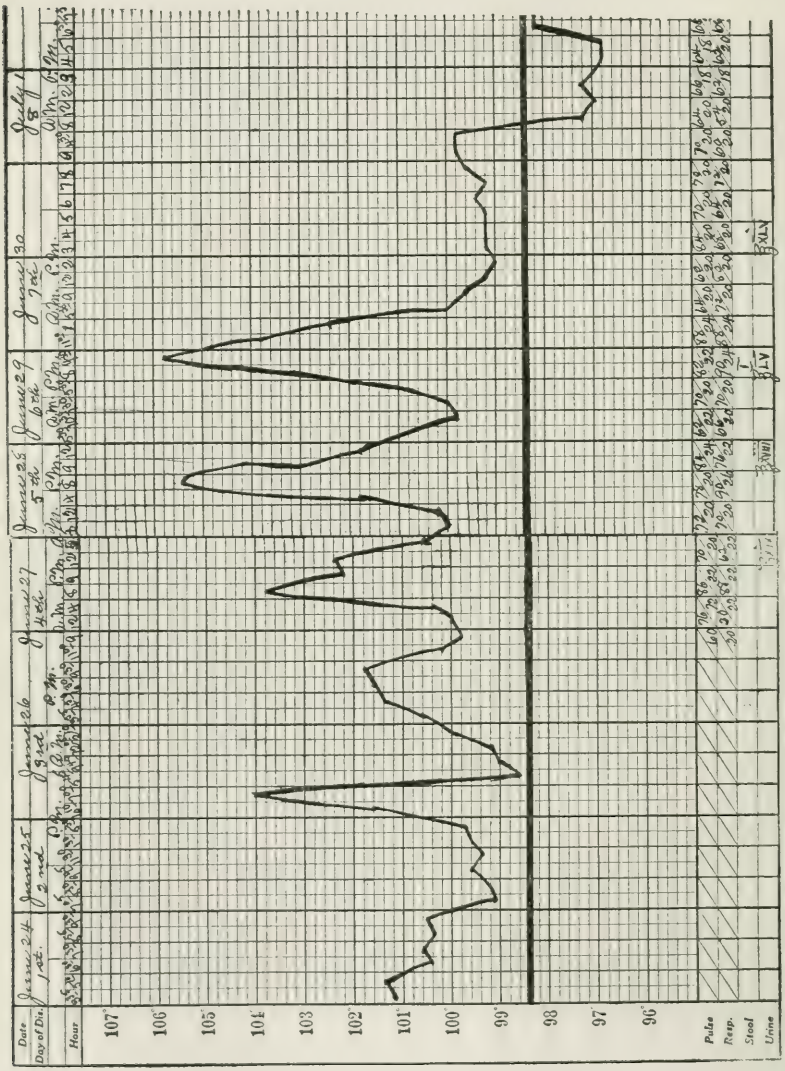


Fig. 130.—Estivo-autumnal malaria simulating double tertian type.

right here. (Takes drop of blood and examines it under microscope.) In the very first field I see some leukocytes that are

strongly pigmented. The pigmented leukocyte, especially mononuclear, with the dark, reddish-brown pigment, while not absolutely pathognomonic of malaria, is always suspicious. This

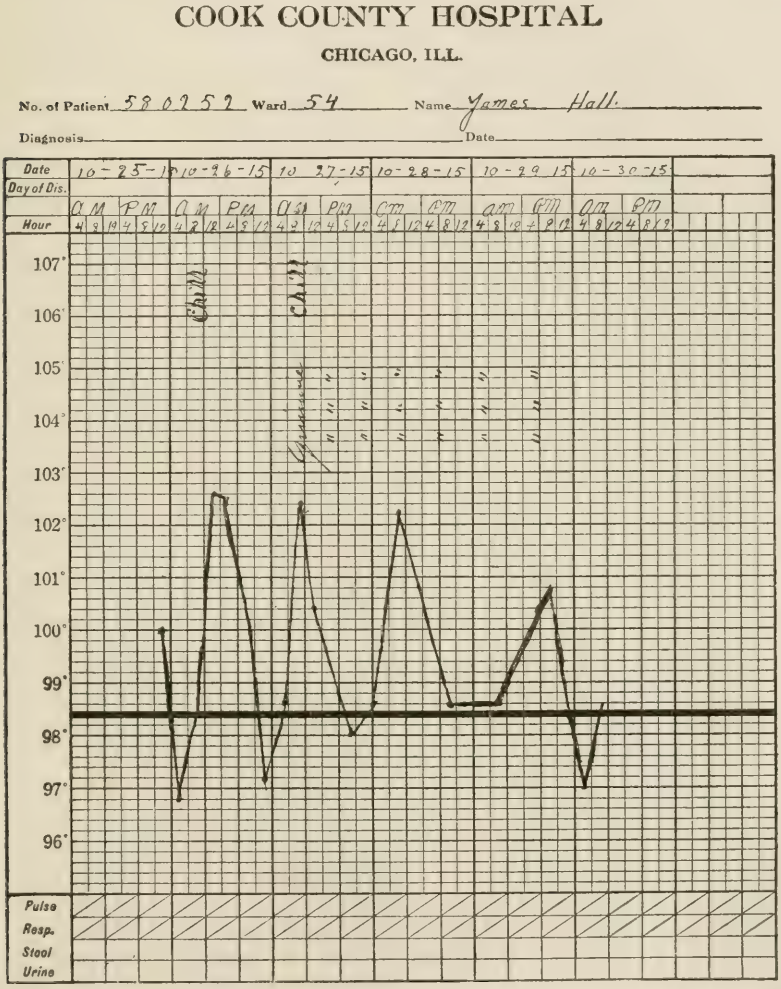


Fig. 131.—Estivo-autumnal malaria, simulating closely a double tertian infection.

fact alone, if I didn't know the man had malaria, would lead me to suspect it very strongly. There are quite a number of these leukocytes, which indicates that the process has been going on

for some time, and that there has been a good deal of destruction of the blood by the parasite. Here I find a perfectly beautiful crescent, and that is positive evidence of the estivo-autumnal type of malaria. The crescent is one of the gametocytes or sexual types of the parasite and is an absolutely positive sign of the estivo-autumnal type. While it is always easy to recognize these crescents after you have once seen one, they are in many instances very hard to find. In many cases the parasites are extremely scarce in the peripheral blood, and so you must not think it is always such an easy task to find them as this has proved, and if you look for them two or three minutes and don't find them you must not conclude they are not there. It sometimes takes a careful search of two or three hours, and even repeated searches.

Of all the types of malaria, the estivo-autumnal is the most malignant. In this locality (Chicago) estivo-autumnal malaria is rare; I see possibly two or three cases a year—not more than that. The severe and fatal cases of malaria are almost all of the estivo-autumnal type; it is the type which furnishes the great proportion of fatalities; therefore it is very important to be able to recognize the organisms.

Now let us go back for a minute to the difference between the tertian type and the estivo-autumnal type. The quartan is very rare. I have seen but one case in two or three years. In the first place the estivo-autumnal type tends to form the ring shapes; the parasite is always small; it never enlarges the corpuscle. You will remember that when I showed you the tertian parasite it had enlarged the corpuscle until it was almost twice the size of the normal one. In the estivo-autumnal type the parasite rarely ever becomes more than half as large as the corpuscle. The next thing is that in the estivo-autumnal type you do not see the segmenting forms in the peripheral blood; I have never seen them, and some authorities doubt if they exist there. Now the gametes, the sexual forms of the estivo-autumnal type, occur principally in the shape of crescents and ovoids, and these are the forms by which the estivo-autumnal type perpetuates itself. Furthermore, these crescents occasionally persist in the blood for a long while, even after the use of quinin for considerable periods of

time and after the patient becomes afebrile. I remember seeing a family with this type of the disease a few years ago—a father, mother, and child—and notwithstanding the fact that they were given quinin persistently, after two or three months, when they were dismissed from the hospital, there actually seemed to be more crescents in the blood than there had been before.

Some authorities divide the estivo-autumnal type into two subdivisions, but all that is necessary for our purpose is to recognize the three ordinary forms of malaria—the tertian type, the plasmodium of which is known as the Plasmodium vivax; the quartan type, which is known as the Plasmodium malariæ; and the estivo-autumnal type, which is known as the Plasmodium falciparum.

You can see how easy it would be, if you depended upon the history in a case of this sort, to make a mistaken diagnosis. The man at first had a definite chill every other day and then one every day; it would be absolutely impossible to make anything but a diagnosis of tertian malaria if we depended upon the history alone. It is very necessary to make the differential diagnosis between the benign types and the estivo-autumnal type, so you see you are not justified in relying upon the history alone. Here we have a history of what seemed to be a tertian malaria, which turns out to be due to the estivo-autumnal parasite. On the other hand, we occasionally get types of malaria where the fever, especially if the infection has lasted a long time, is more or less continuous, and yet you will find the tertian organism. My experience teaches me that the diagnosis when based on the temperature alone may be misleading. *The real diagnosis should be made only on the examination of the blood, and that settles it easily.* The differential diagnosis between the tertian and estivo-autumnal types is then a matter of great simplicity.

Now about the *treatment* of this case: I am an advocate of the giving of quinin at such a time that it enters the blood just at or before the time of sporulation, because, while it acts upon the organism at all stages of its development, it acts much better upon the young parasite. Some authorities think quinin may be given at any time, without reference to the occurrence of the

chill. Of course, when you are not able to predict the chill, and can tell nothing from the temperature, then give the drug so that it is distributed pretty well throughout the twenty-four hours. This patient has had no quinin, but I should recommend for him 30 grains, given in $7\frac{1}{2}$-grain doses four times a day, until he becomes afebrile, and then about one-half of that amount, given for a long period of time, until you can no longer find any of the parasites in the circulating blood. Remember that the estivo-autumnal type is very hard to eliminate, and that even after a long period of time a mosquito biting him could convey the disease to someone else, or it might light up again.

Just one more word on the subject of the differential diagnosis: This case was simple; the history was such as to lead you to suspect malaria at once and the blood examination made the diagnosis absolutely certain. But I have seen many, many cases where it was almost impossible to tell malaria from typhoid for a day or two. I have seen these cases treated for several days upon the assumption that they were typhoid fever, but one does not see a typhoid treated for estivo-autumnal malaria. The reason for this is probably that the organism is extremely hard to find in some cases, especially if the patient has taken small doses of quinin beforehand. Be sure that you continue the treatment until the organism has been eradicated from the blood, for if you don't, the patient is almost certain to have a relapse. It is possible for a patient to be afebrile for many weeks and still have the parasite in his blood. Another very important point in this case is the anemia—he has only about three million red cells. That is very common in malaria, since the parasites destroy the red corpuscles very quickly. A loss of two million corpuscles per cubic millimeter will sometimes occur in a few days.

Treatment of Malaria in General

Now, gentlemen, you have observed from the way we treated these three cases some of the principles in the treatment of malaria. Let us go a little more into detail. It would be superfluous to say that since we have quinin at our command, the drug

which above all others is a specific, there is not much excuse for anyone failing to treat malaria in a thoroughly efficient manner. It really resolves itself into the question of *how* best to give quinin. The guiding principle is that the parasite is most readily destroyed when free in the circulation, before entering the body of the corpuscle in which it is to take up its abode. This is just after segmentation. Our aim then must be to get the maximum concentration of quinin into the blood at about this time. Theoretically, the ideal treatment is a single intravenous injection at the time of segmentation. This is frequently impracticable and usually unnecessary. Fortunately, while this is the best time for the destruction of the parasite, the latter can also be destroyed after entering the corpuscle, contrary to the earlier belief, so even if the quinin acts on the parasites a little later they will be destroyed in a satisfactory manner. One large dose of quinin just before the expected chill will destroy that group of parasites in a satisfactory way. About 10 to 15 grains is a proper adult dose. I never give it in pill or tablet form, since they are only soluble with difficulty in some instances. Oral administration is best carried out by giving the salt in solution. It is bitter, but efficient. The dihydrochlorid is an excellent salt and very soluble.

A very excellent method, because of the certainty with which the quinin reaches the circulation, is that of intramuscular injection. The disadvantage is the possibility of abscess formation. I have never seen it myself, and I have used this method not infrequently. The quinin and urea hydrochlorid, which is very soluble, is a good salt for the purpose. A single dose of 10 or 15 grains just at the time of the chill is sufficient. An additional 5 grains thrice daily by mouth is sufficient to destroy any parasites that may have escaped the injected quinin. Intravenous injection should be reserved for the pernicious cases, where it should be promptly instituted. A half liter of normal saline solution containing 1 gram of quinin dihydrochlorid is warmed to 100° F. and injected into a vein. The method is not entirely free from risk, and hence is not likely to become generally used, except in severer estivo-autumnal infections. In the ordinarily

severe cases of this latter type the best method, since the time of the chills cannot be predicted with certainty, is to give the drug by mouth at three- or four-hour intervals in 5-grain doses. More than 30 grains (2 grams) per diem is practically never necessary. The enormous doses so often given, even in mild infections, are entirely unnecessary. Indeed, there have been deaths attributable rather to the overdoses of quinin than to the malaria itself.

I personally prefer to give quinin in the manner I have just indicated, and yet some of the very best and most experienced students of malaria believe that even in tertian and quartan infections better results may be obtained by giving the drug in 5-grain doses every two or three hours, by mouth in solution, beginning the moment the diagnosis is made.

A very important question, in localities where there is much estivo-autumnal infection, is what to do with the so-called gamete carriers. The gamete forms, the crescents and ovoids, can often be found in the blood when there has been no sign of any active infection for a considerable time. They are certainly difficult to eradicate, but the best opinion goes to show that if quinin in sufficient dosage, say 30 grains (2 grams) per diem, in an efficient form be given over a period of four to six weeks, they can ultimately be made to disappear.

HEMORRHAGIC PLEURISY

Generalized Sarcomatosis Five Years After Removal of Original Tumor. Metastases Appearing in the Skin and Pleuræ.

DR. WILLIAMSON: The first case that I wish to present today is a little out of the ordinary, and I am showing it because you don't often have an opportunity of seeing such cases in a medical clinic. This man is a German, forty-six years old, a contractor. He came into the hospital complaining of pain in the right side of the chest, extreme shortness of breath, cough, expectoration and weakness, which began six weeks ago; at that time he developed

cough and pain in the left side of the chest. The cough has been constantly present, accompanied by very thick, tenacious, yellow mucus. The pain is very severe and constant, influenced by deep respiration, seems to be localized in the left axillary line. The dyspnea began six weeks ago with the pain and has been getting worse. He has had occasional hot flashes, but has had no distinct chill. The chest seems clogged up, and he often has a marked choking sensation. We have already tapped his chest and removed 3000 c.c. of fluid from the left side.

Today the dyspnea is nearly gone. We see that he is pretty badly emaciated. The eyes, ears, nose, and throat disclose nothing. The tongue is dry and coated. He shows all the evidences of having lost a good deal of weight. The respiration now is very nearly equal on the two sides; before the chest was tapped the respiratory excursion on the left was almost nil, no pleural rub could be felt, and there was flatness over the entire left chest. At the present time the lung borders on the right side move freely; on the left side they do not move, showing that there are some adhesions present. The flatness over the left side of the chest has entirely disappeared, except perhaps over the lower two ribs, where there is still a little fluid.

On auscultation the signs are negative, except that over the slight area of flatness the voice sounds are absent.

As we look over his body we notice two or three things that are rather out of the ordinary. In the skin, just over the second intercostal space, there is a little subcutaneous nodule, perhaps twice as big as a bean. On the left side there is another one as big as a split pea; on the right side, just below the nipple, there is still another. On palpating the glands we find no enlargement until we come down to the inguinals, which, on the right side, are about as big as a hickory nut, large and hard, but evidently not very painful.

Examination of the heart is negative and the abdomen shows nothing abnormal.

His chart shows that he has had a moderate degree of temperature, running up as high as 101° F., and sometimes nearly to 102° F.; it is 101° F. at present. The pulse runs 115 to 120 most

of the time. The blood-count was 20,000 whites. The urine showed nothing abnormal except a small amount of albumin. The fluid that we got out of the pleural cavity was *intensely hemorrhagic;* it looked almost like pure blood, but did not coagulate. Cultures of this fluid have shown nothing abnormal; there have been *no tubercle bacilli.* Microscopic examination shows an enormous number of red cells and a great many endothelial cells. Now the question is, what have we? The man came in with all the evidences of an ordinary pleurisy, and the only thing that strikes us as being out of the way is this hemorrhagic fluid. This is not an accidental affair occasioned by puncturing a vein; that sometimes happens, but this fluid came out looking like pure blood from beginning to end. The first thing we have to ask ourselves is what types of pleural effusions give hemorrhagic fluid. Hemorrhagic pleurisies occur in several different conditions. In the first place, we occasionally find them in typical tubercular pleurisy, though in a tubercular pleurisy, as a rule, the fluid is straw colored and clear. Then we get hemorrhagic pleural effusions in profound septic conditions, such as malignant endocarditis. I had the opportunity, when I was in Leipzig, of seeing an anthrax case with a hemorrhagic pleurisy. Then, again, we find hemorrhagic pleurisies in certain of the dyscrasias; occasionally we find them in such conditions as chronic Bright's, and in purpura we sometimes find this form of pleurisy, and, lastly, we sometimes find this condition associated with some of the malignant tumors—carcinoma, sarcoma, and endotheliomata. The temperature would make us think a little more of tuberculosis, but the temperature is not very marked, and let me add that in almost any pleurisy you can find temperature. We have not been able to find anything tubercular about this patient. He shows no evidences of any of the hemorrhagic diatheses—scurvy or any of that group of diseases. That brings us to the profound septic conditions. The man is not profoundly septic. Since his paracentesis he has been comparatively comfortable and there is no other evidence of sepsis.

That brings us to the last group—the malignant tumors. And then we come to the point of asking about these three little

tumor masses in the skin. (To Patient): How long has it been since you first noticed these?

PATIENT: Quite a while.

DR. WILLIAMSON: Before you got the pleurisy?

PATIENT: Yes, before that. These are smaller now.

DR. WILLIAMSON: He says the glands in the right inguinal region have been larger and are getting smaller.

That leads us to investigate and find out if there is anything indicating malignancy, and questioning along this line we find that five years ago he developed a mass at the lower end of his right femur or somewhere about his right knee. He went to a very distinguished surgeon, who told him he had a sarcoma of the bone, and the leg was amputated at that time. That gives us at once a very definite clue. Despite the long period of time that has elapsed since then (five years) I think this represents a general sarcomatosis. Sarcomata have a particular tendency to form metastases in the skin. Whenever you find such tumors in the skin they nearly always represent sarcomata. In a post-mortem about a week ago we had this demonstrated on a man who came in five months previously, saying that he had had an accident to his eye. The eye was treated and he left after a short time, and a few weeks before his death came in again with an enormous number of metastases all through his skin. Post-mortem revealed the fact that the supposed injury to the eye was a sarcoma and these tumors were all metastases.

These metastases have a tendency to develop in the pleura as well as the skin. I wanted to show you this case because of these developments. The man came in with all the evidences of pleurisy. It required only a moment to ascertain the presence of an exudate. There is no question in my mind about the condition; he has a diffuse sarcomatosis which localized itself in part in the pleura.

The mode of its invasion into the pleura is not known. We could not say whether it was conveyed there by the blood-stream, as it generally is, or through the glands, but we have some additional information in this *x*-ray picture, which shows very beautifully some large masses in the glands of the mediastinum.

The lesson to be learned from this case is this: A hemorrhagic pleurisy should always make us suspicious of a tuberculosis, one of the various hemorrhagic conditions, some profound septic conditions, or a malignant tumor. The more pronounced the hemor-

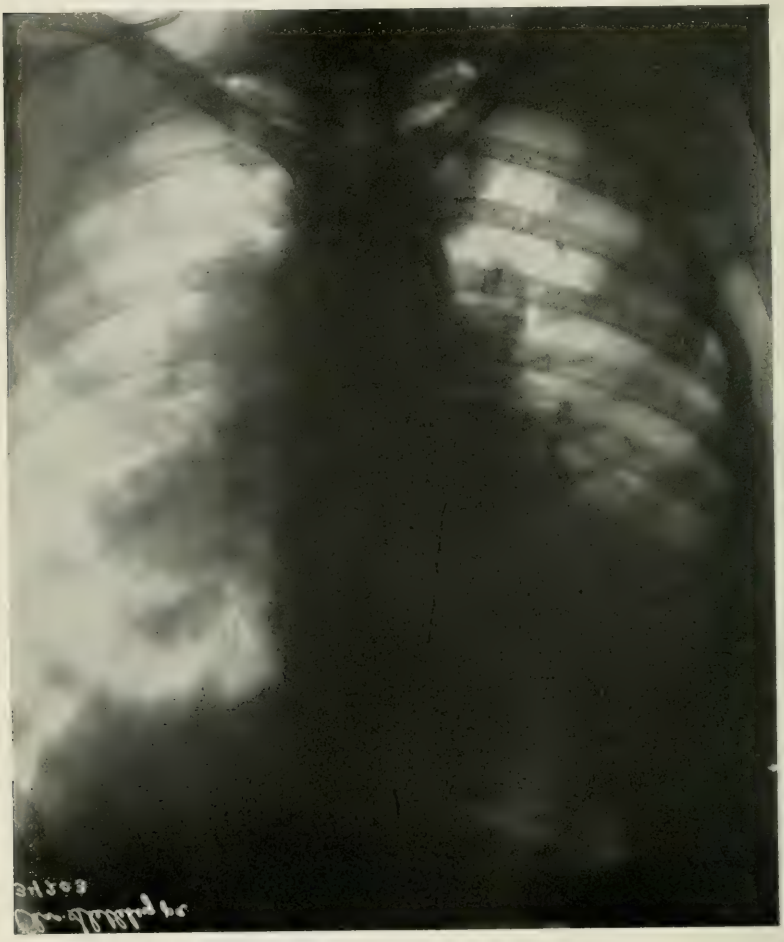


Fig. 132.—Sarcomata (metastatic) of the mediastinum.

rhagic exudate, the more suspicious we must be of malignancy. Then you must locate the source and discover the original tumor. In this patient there is very little doubt that it originated in his sarcoma of five years ago.

Probably the reason that the inguinal glands become smaller is that he has been on treatment with some toxin. He has had some terrific reactions from these toxins, but in a general way he thinks he is better than he was a month or two ago.

NOTE.—One of the cuteanous nodules was removed later and examined, and found to be sarcomatous.

TRICHINOSIS

Simulates Typhoid Fever and Rheumatism. Eosinophilia Often Furnishes the Only Clue to the Trouble. Diagnosis Established Either by Blood or Muscle Examination. Characteristics of the Trichina and Methods for Detecting It. Thorough Cooking of Pork the Only Safeguard Against the Disease.

DR. WILLIAMSON: This lad is eighteen, an Italian laborer. I want you to notice that he got by the examining room with a diagnosis of organic heart disease and kidney trouble, his local symptoms being so inconspicuous. He speaks very little English, and what history we have been able to get we obtained through an interpreter. What he complains of is pain low down in the back, in the biceps, and calves of the legs. He came in on the 7th of this month, said he had been feeling sick for several weeks, but just felt bad all over. His present complaint began about ten days before he came into the house. He says before he had the pain his eyes were swollen, and from his description we would say that he had an edema of the lower lids. *This had practically disappeared when he entered the hospital.* He said the conjunctivæ were red and injected. A few days after the appearance of this edema he commenced to have pain in the back. The pain was not constant, but occurred irregularly, and frequently was cramp-like. He had a few chilly sensations, but no real chills, and, he thinks, no fever. Looking at his temperature chart we see that he had a little fever when he came in, about 101° to 101.5° F., but it only lasted a couple of days. For the past four or five days he has been up and around the ward.

The blood-count showed 10,500 leukocytes. Examinations

for malarial parasites have been negative; a Widal was made and proved negative, as did also a blood-culture. Will someone suggest a diagnosis?

VISITOR: A trichinosis.

DR. WILLIAMSON: Why a trichinosis?

VISITOR: The pain in the muscles and swelling of the eyes.

DR. WILLIAMSON: With what symptoms does trichinosis generally set in?

ANOTHER VISITOR: Intestinal disturbance.

DR. WILLIAMSON: Patients generally have pain in the abdomen, diarrhea, and usually the pain and diarrhea are so marked that many patients come in with a diagnosis of typhoid fever. That is a very common occurrence in this hospital. Does this resemble an ordinary case of trichinosis? Just having muscular pains for a few days with no abdominal symptoms? No; these patients usually give a history at least of having abdominal pain. We have done our best to get a history of some such symptom, but the patient stoutly maintains that he had nothing of the sort. He says he eats very little pork; eats a good deal of meat, but mostly beef, which does not give trichinosis.

Now what do we have to think of? First, of typhoid. The physical examination showed very little. He had no pain, except a slight one over one deltoid. The edema of the eyes had almost entirely disappeared and the thing that he most complained of was fatigue. The first clue we got was when we made a differential blood-count, which showed 53 per cent. of eosinophiles on the first examination, and a second examination made two days later showed 48 per cent. instead of the normal count of about 2 per cent. I want to call your very particular attention to the development of the eosinophilia. It is one of the most striking findings there is, and makes us think of trichinosis at once. Very few diseases present an eosinophilia, so trichinosis is the first thing to think of in spite of the fact that this is a long way from being a typical case.

The only proper method of making a diagnosis is in one of two ways: The first way is to cut out a piece of the muscle and find the trichinæ. The second way is to find the trichina

larvæ in the blood. It is said that they can occasionally be found in the stools, but I have looked for them many, many times and never found any. We have snipped out a piece of a muscle and have found a large number of the trichina larvæ, which you see here under the microscope. This was taken out three days ago and preserved in glycerin jelly. As I have said before, it is a very nice way to preserve such specimens as these.

Now just a word about trichinosis: It is a much more common complaint than is usually believed. I am pretty sure that many cases are never diagnosed until they are seen at post-mortem. I am pretty sure also that if the examiner will look carefully about the muscles of the sternum and in the gastrocnemii he will see many trichinæ in cases that were never suspected. The trichina is one of the round worms, the female being larger than the male, and is just about big enough to be seen comfortably with the naked eye. The female runs about 3 mm., the male about $1\frac{1}{2}$ mm.

What is the life history of the trichina? It is this: A man becomes infected through eating the flesh of a trichina-infested hog. That is the usual manner of infection. The hog harbors the trichina parasite. These parasites are small, grayish organisms that live in the muscles of the hog, become encysted, and sometimes are surrounded by an area of calcification. Now let us see what a man does to a piece of pork that is infected with trichinæ. The outside capsule is immediately digested off and this little parasite which grows to be 2 or 3 mm. in length, inhabits the intestines of the man. After a short time the male parasite dies off and leaves only the female. Remember that these trichinæ do not lay eggs, but their young come out alive as small live worms. Each mother worm will produce several thousand larvæ. These larvæ, to start with, are about 50 to 100 microns in length; they are about ten times as big as a red blood-corpuscle and cannot be seen with the naked eye. I forgot to say that the mother worm becomes adherent to the wall of the intestine, but the larvæ find their way through the intestinal wall, into the blood or lymph-stream, and lodge in the voluntary muscles. We know that they get into the blood-stream because if you

examine the blood while the abdominal pain is still sharp you can sometimes find these larvæ. Their seat of election is in the muscles, where they act as a foreign body and produce an inflammation of the muscles, a true myositis. In man these larvæ lie the long way of the muscle. They become encapsulated in most instances and sometimes become calcified and there they stay. So you see we begin with the encysted stage in the flesh of the hog; we eat this flesh, the digestive juices digest the capsule, and the mother worm starts at once to produce these larvæ.

I want to demonstrate to you the way to take out a bit of muscle to search for the trichina. It is not a difficult operation at all. The best thing to use is an ordinary scalpel. Inject a little novocain into the skin, wait a few minutes for anesthesia to occur, cut down onto the muscle with the scalpel, snip out a piece with a sharp pair of scissors, tease this out with a pair of needles, and put it in a drop of glycerin under the microscope. The best place to find them is in the calf of the leg. The worms are generally curled up, and you can usually recognize the head and tail ends, the sharp end being the tail.

If you get a case in the very early stages it is best to try to isolate them from the blood. The way to do this is to puncture a vein, take a few cubic centimeters of blood and add about ten times as much 3 per cent. acetic acid, put into a centrifuge and centrifuge hard. After taking out the sediment you will usually find the larval worms. We tried it in this case, but were not successful in getting them, because his abdominal symptoms had passed and there were not many worms circulating in the blood at that time. This is quite a mild case of trichinosis, and such a case is very easily overlooked. It is interesting to note that the patient got by the examining room with a diagnosis of kidney trouble on account of the edema of the eyelids, and because his pain had gotten much better.

Trichinosis is not a rare disease. I probably see anywhere from ten to fifteen cases a year, and any condition which one man sees a round dozen times within a year cannot be called rare.

To sum up. In the first place, trichinosis is much more com-

mon than it is supposed to be; second, the majority of the cases are rather mild; third, the more severe cases simulate typhoid, while many cases are called muscular rheumatism. I think that should always put you on your guard—when a patient complains of soreness in the muscles, particularly if it is preceded by addominal symptoms. The next thing to do is to make a differential blood-count; there is usually a pronounced leukocytosis, and when you see that a fairly large percentage are polymorphonuclear eosinophiles it ought to make you very suspicious of trichinosis. Not all cases have eosinophilia; just why that is we are not prepared to say, but it seems to be borne out in the guinea-pig. Severe infections do not, as a rule, produce as marked eosinophilia as the milder ones.

The recognition of the worm in the muscles is very simple. It does not look like anything else. It is usually curled up and you can find it without much difficulty.

A word or two about the prognosis and treatment. The prognosis of trichinosis is, I think, not nearly so grave as it is supposed to be. If we could include all the cases we would find that trichinosis has a rather low mortality. My own experience leads me to believe that it is only 2 or 3 per cent. I should say that in the severe infections—one that looks like typhoid—the mortality is quite high; it depends upon the number of the worms. If there is a large number of course the prognosis is much more grave.

Where does the edema of the eyelids come from? Presumably from localization of worms about the orbit. Another symptom has been noted—shortness of breath without any particular exertion. A man comes in with a severe dyspnea without any cause for it; that sometimes occurs in trichinosis because of the localization of great numbers of these parasites in the diaphragm. Then you sometimes get a hoarseness and aphonia, due to an accumulation of the parasites about the larynx, but this certainly is not very common.

In taking out the little bit of tissue for examination be careful not to crush it all to pieces. Try to do as little trauma to it as possible, teasing the fibers apart carefully. We might discuss

for a moment the life cycle of the trichina. We stated that a man generally gets it from the hog, but where does the hog get it? That has never been very conclusively settled. We know that the rat has it, and that rats that frequent slaughter-houses are more likely to have it than the others. We don't know whether the hog gets it from eating the dead rats, which they will do, or whether the rat gets it by eating the flesh of the dead hog, but these two animals seem to be responsible for keeping up the supply of trichinæ.

What can we do to prevent it? In the first place, rigid inspection of meat, which I imagine in a general way is rather loosely carried out. The second thing is the individual prophylaxis. If pork is cooked thoroughly it will surely destroy the trichinæ. I think we generally get this disease from ham, especially ham that is baked without first being boiled. A large ham is put in to cook and often is not thoroughly done. A continued temperature of 70° C. is sufficient to kill the trichinæ, so the important thing is to cook pork very thoroughly. A good many cases occur in German neighborhoods from eating pork sausage. Germans will often eat practically raw pork in this way, and it is very apt to give rise to an epidemic of trichinosis.

It sometimes takes quite a little bit of hunting to find these parasites. The best way, as we have already noted, is to take a little bit of the tissue, put it on a slide, and then tease it. It may have struck you that I was a little bit more generous with the other fellow's gastrocnemius than need be, but I want to use this for some animal experiments. We will feed this trichinous flesh to a rat and perhaps one or two other animals.

Remember that you must not expect to find these parasites as you do bacteria; generally a ten or fifteen minutes' search will reveal two or three parasites. The question often is asked, "Is it desirable to cut down upon that piece of muscle where the patient has most pain?" I don't know as to that; I generally use the outer surface of the gastrocnemius because it is a great big muscle mass, and a little bit can easily be spared from it, and the patient will not be embarrassed by a scar in that locality. I think there is nothing to gain by cutting down on the point where

he has the most pain. *Remember to use, as in all unstained specimens, very little light or you won't be able to see the parasite;* sometimes when you are very fortunate you will find two or three of these worms together.

TREATMENT OF TRICHINOSIS

The treatment of trichinosis is very unsatisfactory, in that the diagnosis is rarely made and seldom possible before the lodgment of the worms in the muscles. The only thing which might be legitimately expected from the treatment is the expulsion of those adult worms still in the intestinal tract so as to prevent the development of more embryos and their subsequent migration to the muscles. A brisk cathartic or, preferably, several of these should be administered the very moment a diagnosis of trichinosis seems probable. The various anthelmintics may be tried. Probably the best of these is thymol, but it must be always kept in mind that we have no drug which in any way influences the worms which have already lodged in the muscle.

Systematically, moist heat is useful to help control the myositis consequent upon the development of the muscle forms. The pains are rarely so severe as to demand morphin, although I have seen a case or two where this drug was necessary to keep the pain within reasonable bounds. Fortunately, with the encapsulation of the parasites the muscle soreness comes to an end, so that, in a sense, the infection is self-limited.

CLINIC OF DR. ROBERT B. PREBLE

St. Luke's Hospital (at Bedside)

PLEURISY WITH EFFUSION PRODUCING GREAT CARDIAC DISPLACEMENT

Rapid Improvement after Thoracocentesis. Estimation of Fluid in Chest and Indications for Aspiration. The Absence of Dyspnea in Such Cases. General and Subsequent Treatment.

October 20, 1915.

Dr. Preble: This boy, eighteen years old, came into the hospital two days ago complaining of a fever of about three weeks' duration, with general weakness, rapid breathing, some cough, sweats and chills, but no pain. The chills were present only during the first night. He worked as usual on the 30th of September, but went home that evening feeling rather badly, had some pain, and developed a fever. For three or four days he got up and dressed, but did not go out; since about the 2d or 3d of October he has been in bed. He has had night-sweats, sometimes every night, sometimes every other night, sometimes twice in one night. He says he was always well before this illness. He had no pain except during the first night, but of late has been coughing, and recently has been expectorating some dark grayish, dirty material. His appetite is fair; stomach and bowels normal. What would you think about that?

Visitor: The fact that he had a chill and sweats and fever would indicate some sort of an infection, and the fact that he had a cough that was at first non-productive and then productive would make us think of the respiratory tract.

Dr. Preble: Yes; the mode of onset is that of an acute infection; he worked all day and then went home feeling badly

and has been feeling badly ever since. Then the onset of the cough would make one think of a respiratory process, but is that conclusive?

VISITOR: It might be a heart affair.

DR. PREBLE: Could it be a typhoid?

VISITOR: Yes, that is possible.

DR. PREBLE: Could it be a malaria? Could you have a cough in a malaria?

VISITOR: Yes.

DR. PREBLE: Could you have it in a septic condition?

VISITOR: Yes.

DR. PREBLE: In practically all of the acute infections there is a bronchitis, and it varies all the way from one which is scarcely noticeable to one which is severe. In a typhoid there is often such a severe bronchitis and so intense a cough that it veils the symptoms of typhoid so that one would naturally think of a respiratory process, and the history would suggest an acute infection. He has been sick for three weeks; he came in with a temperature of 102° F.; later in the day it went to 103.2° F. Yesterday it ranged from 100° to 103.2° F.; this morning the lowest point is 99.3° F. He has had a temperature all of the time. The pulse has ranged from 90 to 120, respirations from 18 to 28. Is there anything suggestive about that?

VISITOR: It is a septic temperature, not that of a typhoid.

DR. PREBLE: While, of course, it suggests that, the maximum range for a single day was three and a fraction degrees, which is not such a septic temperature. What does it suggest to you, Dr. F.?

DR. F.: It might be the latter part of a temperature curve of a typhoid fever.

DR. PREBLE: It might easily be; in the latter part of a typhoid a temperature of 103° F. and a pulse of 120 is not at all unusual. The essential thing that it must suggest is that the process is one which has gone on for a long time, and it throws out of consideration a whole lot of things. For example, one would not think of it as an ordinary influenza nor of a pneumonia. Then, too, one would say three weeks is a long time

for a pneumonia, and yet the onset suggests pneumonia, but three weeks is rather a long time for a temperature to continue from a pneumonia unless complications of one sort or another developed. Now that the temperature has continued for three weeks, does that sound like a typhoid?

VISITOR: It sounds like typhoid to me.

DR. PREBLE: In what way?

VISITOR: Well, you expect a temperature to last that long in typhoid.

DR. PREBLE: Yes, and much longer than that; they are lucky if they get out of it that soon; but, on the other hand, did that begin like a typhoid?

VISITOR: No, it began more like a pneumonia.

DR. PREBLE: Yes, it began like a pneumonia much more than like a typhoid. The mode of onset does not suggest typhoid, although the temperature does. How about his chills and sweats? He had a chill to start with and has had numerous sweats since.

VISITOR: It might be a miliary tuberculosis.

DR. PREBLE: Yes, it might be some type of tuberculosis—the temperature suggests that. Sweats frequently occur with a tuberculosis.

VISITOR: The pulse is pretty high.

DR. PREBLE: Well, the pulse is rather a slow one on the whole; how about the mode of onset?

VISITOR: It might be all right for that.

DR. PREBLE: Yes, tuberculosis may begin with great acuity, but it has now been going on for three weeks, and one would say that with an acute tuberculosis a patient ought to look worse than this boy does at the end of three weeks. Let's see what we can find (removes patient's shirt). What do you think about him as you look at him now?

VISITOR: He looks just about medium.

DR. PREBLE: What would you say about his mentality?

VISITOR: He looks all right.

DR. PREBLE: Yes, he is an intelligent, perfectly clear-headed boy. There is no obscuration of his intellect at all; he lies here perfectly comfortable, and one would say that he had

not been sick a great while. For a boy of his age he is well nourished; not particularly muscular, but he does not impress one as being sick. There is no discoloration, no dyspnea; he does not look as if he was in any pain. What do you notice about the thorax?

VISITOR: The respirations are more costal than abdominal.

DR. PREBLE: Are the respirations symmetric?

VISITOR: It looks as if they were a little deeper on the right than on the left.

DR. PREBLE: Movements are a little freer on the right than on the left; does it look as if there was any difference on the two sides?

VISITOR: No; when he is quiet I can't see any difference.

DR. PREBLE: It looks to me as if the right was a little fuller than the left, but the most conspicuous difference is that the right moves more freely than the left. Dr. E., what do you see that is most conspicuous?

DR. E.: A pulsation on the right side.

DR. PREBLE: Yes; beginning at about the third interspace one can see a definite pulsation which extends out toward the right practically to the nipple line. What do you suppose that is? It is no place for a pulsation, and, as a matter of fact, that is the thing that ought to attract your attention at once—that's the striking thing.

DR. E.: How long has he had the fever?

DR. PREBLE: About three weeks.

DR. E.: There might be some change in the heart, a myocardial degeneration.

DR. PREBLE: But just think what that means! We can see that impulse almost at the right nipple line. If his heart were dilated to that size what would be his condition? He would be out of breath, cyanotic, and altogether uncomfortable. One can't think for a moment that that is due to a dilated heart. What can that be? Evidently, there is some body there which is pulsating.

DR. B.: We would have to go into the history and see if that is a congenital heart or if he ever had it before.

Dr. Preble: Do you suppose for a minute that this boy would have ever noticed that thing?

Dr. B.: No, but we would have to consider whether it had been pulled over by adhesions.

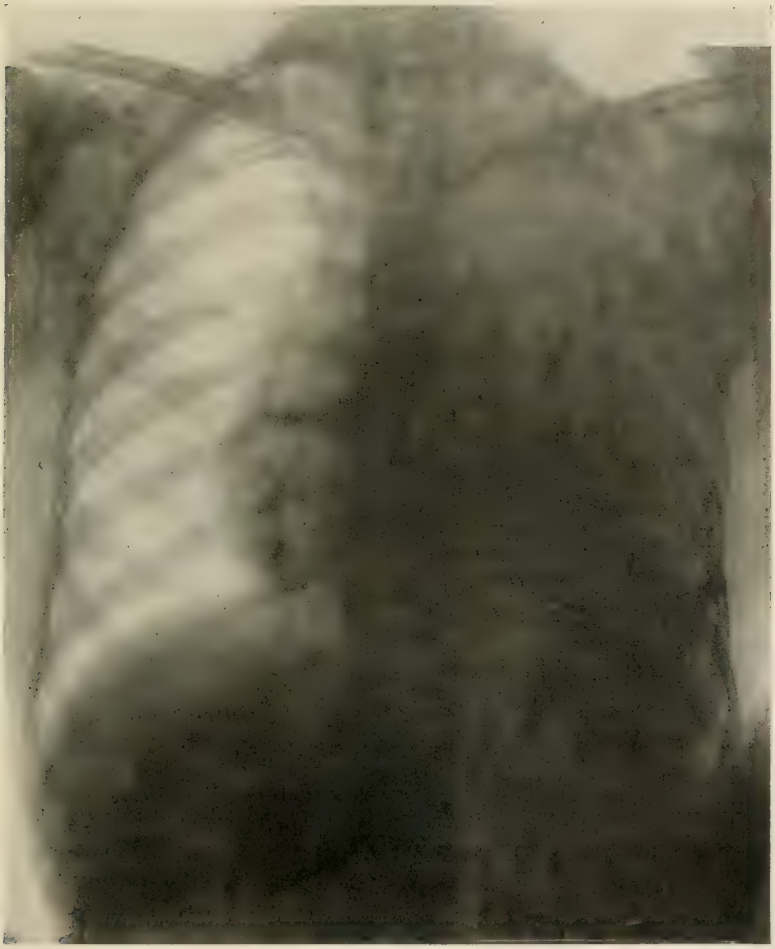


Fig. 133.—Pleurisy with effusion: *x*-ray showing cardiac displacement to right.

Dr. Preble: You are assuming that that is his heart, not a dilated, but a displaced, heart. Now a heart can be displaced to that degree by only a few pathologic conditions. We may

have an inversion of the viscera, that is one thing; but so far as his history is concerned it is practically impossible to get any data. For example, it is not many years ago that we had a student in the Northwestern University Medical School, a sophomore, and that boy never had known that he had a complete inversion of the viscera until he began to make his own physical diagnosis and discovered it. They are very uncommon; the bulk of you will never see one, but they do occur occasionally. But that is a remote possibility, and even if we had an inversion of the viscera, that would not account for his temperature. So, assuming that that is a heart, assuming that it may be part of an inversion, it is only remotely possible. What is the cause of a displaced heart like that?

VISITOR: Being pushed over.

DR. PREBLE: But what would that be due to?

VISITOR: A pleurisy with effusion.

DR. PREBLE: Yes; here is a boy taken ill with a chill, and after a while he began to cough, and then began to spit up a little dark, dirty sputum, and then almost the first thing you notice on examining him is that he has a heart which is pushed way over. So that sounds highly probable. Could it be displaced from any other reason?

VISITOR: Yes, adhesions could pull it over.

DR. PREBLE: Yes; as a matter of fact, one can think of a variety of things that could push a heart over, but they are all remote. What would prevent that boy from having a neoplasm that would push it over —they are rare things, and it is very rarely that subdiaphragmatic affairs will push a heart over to the right; it is much easier for them to push it the other way. The heart is like a pendulum and can be swung either way, but pathologic conditions below the diaphragm usually push it over to the left. Is a pleurisy on the left side of the chest a common thing?

VISITOR: I think it is not as common on the left as on the right.

DR. PREBLE: I don't really know whether they are more common on one side than on the other, but I think they are just

about equally divided. It is a common, everyday occurrence, a pleurisy with effusion, and so it suggests itself at once as a cause for this condition. Now, supposing that is such an affair, why is that boy not out of breath?

VISITOR: He should be out of breath and cyanotic.

DR. PREBLE: He has been here under observation for forty-eight hours and is perfectly comfortable in every way. Does it strike you as a rather unusual thing—a pleurisy with effusion large enough to displace a heart to that extent? What do you think about that, Dr. S.?

DR. S.: If he got up and moved around much he probably would be out of breath.

DR. PREBLE: You would think that a boy with an effusion as large as that would be out of breath all the time. Just think, this whole left side is full of fluid!

DR. D.: All the other patients with a large effusion that I have ever seen have been out of breath.

DR. PREBLE: Was the effusion exudate or transudate? That would make a difference. That is one of the curious things about such a case as this, dyspnea is no part of it. If one lung is thrown out gradually the patients do not suffer from dyspnea. During the acute period, when they have a lot of pain, they may be a little short of breath, or breathe a little more rapidly than usual, but they are very seldom dyspneic. When you see a great big, massive effusion with dyspnea you might say, "Why is that fellow out of breath?" not "Why isn't he out of breath?" One may have a quite massive transudate on the right side without any on the left, and it is a very curious thing that these great big effusions with dyspnea always present the thought that there is something back of it—something beside the effusion. If a lung is thrown out of commission quickly, as happens in a pneumothorax, if rupture of the lung takes place, those fellows suffer from dyspnea very quickly, but where it is so gradually thrown out as it is in these cases they do not suffer. So the most striking thing that you note about this boy is this area of pulsation that extends from the third rib down to the diaphragm on the right side, and in the corresponding area on the left there is

no such pulsation, and then we note that the respiratory movement is freer on the right than on the left. (To Visiting Doctor): See what you can feel on palpation.

VISITOR: You can feel the heart all over the right side and you can't feel it on the left.

DR. PREBLE: That is, you can feel even more certainly than you can see the asymmetry of the movements, and you can feel the pulsation here on the right and note the lack of pulsation on the left. The palpation confirms our findings on inspection. Does it add anything to them?

VISITOR: I don't think so.

DR. PREBLE: Not so far as you have gone, but you have not gone as far as you might. See whether the voice enters into it.

VISITOR (Patient counting one, two, three): It is much decreased all over the left side.

DR. PREBLE: Can you feel it over the left side?

VISITOR: Low down I could.

DR. PREBLE (examining): You can follow it down on the right side from the axillary line to the fifth interspace; over the entire left side you don't feel it at all, except for about $\frac{1}{2}$ inch to the left of the sternum. So you see, the palpation not only confirms our inspection, but it adds to the fact that pulsation does not take place on the left side, and vocal fremitus is absent. Now, let's see what percussion will show (examining).

Over the left side there is absolute flatness—it is just like percussing a brick wall—except at the extreme top, where there is a transmitted impulse from the trachea. The right border of the dulness runs across the sternum at the fourth rib and out along the fourth rib almost to the nipple line, and then curves down and meets the liver dulness at the sixth interspace. Posteriorly, we have that same area of intense dulness, and on the right side we get the lower border of the lung in the normal location. The peculiar thing about it is that we usually get the mediastinal displacement, but here the posterior mediastinal displacement is not present. See what you can find on auscultation, Dr. B.

DR. B.: I think there is a murmur, but I would not say whether it is bicuspid or mitral.

DR. PREBLE: Suppose you just compare those two sides and neglect for the time being the cardiac phenomena. Is there any difference?

DR. B.: I can hardly hear anything at all on the left.

DR. PREBLE: Yes; you can hear hardly anything at all on the left. The breath sounds are entirely gone, while they are present and even exaggerated on the right side.

(With fluorescent screen the heart is seen displaced to the right; the right lung is clear; the diaphragm on the right is freely movable; the left chest is opaque.)

October 23, 1915.

DR. PREBLE: How do you feel this morning, Joe?

PATIENT: Fine.

DR. PREBLE: What do you see, Dr. D.?

DR. D.: The pulsation doesn't seem to be so marked as it was the other day.

DR. PREBLE: No; the left side is still quiet though. (To Patient): Do you sleep well, Joe?

PATIENT: Yes, I sleep all right.

DR. PREBLE: Which side do you sleep on?

PATIENT: I just lie like this on my back.

DR. PREBLE (percussing): Do you remember that area of dulness which you found three days ago, Dr. B.?

DR. B.: It seems to me it came over further to the right last week.

DR. PREBLE: Yes, it was just about like this (indicating); so it has drawn in and the heart has shifted back toward the left about 1 inch. On Wednesday this area here at the clavicle was dull, but there is now some resonance, so the air is entering the upper lobe to a certain degree and things are getting better. Do you suppose that small amount of fluid we removed (you know we didn't get more than 50 c.c.) could do that? It seems as if the withdrawal of even that small amount stimulated absorption, so that it has gone down quite a lot in the last three days. What more would you do with him, Dr. H.; would you draw off some more fluid?

DR. H.: I don't think so, not right away.

Dr. Preble: That is the conclusion we have come to; to see if by keeping his bowels pretty loose and his diet pretty dry it won't absorb. I fully expected to go in there again, but he was so much better the next day that we decided to wait. The cultures of the fluid were negative. So we will keep him quiet, in bed, and keep his bowels loose—with what?

Dr. H.: Salines.

Dr. Preble: The salines are used pretty generally, but he is not very responsive to them, so I thought we would give him a little elaterin, $\frac{1}{10}$ gr., every hour for two or three hours in the morning. Then by four or five o'clock in the afternoon the bowels quiet down and he has a good sleep. What's going to become of the boy, Dr. D.?

Dr. D.: He's going to be all right.

Dr. Preble: Oh yes, the great chances are that he will. How about the ultimate outcome?

Dr. D.: I think he is likely to have recurrences.

Dr. Preble: Yes, but tubercular pleurisies usually get along pretty well.

Dr. D.: Would the fact that the fluid looked tubercular be a reason for not removing any more?

Dr. Preble: If he had only a small amount, but he has probably 1500 to 2000 c.c. in there, and the question of mechanical interference comes in. I am not absolutely sure that we are doing the best thing by waiting, but we are keeping him absolutely quiet in bed and think it will be all right, but I may change my mind tomorrow. In smaller amounts of fluid, say 1000 c.c., we would just let it be, but you can see how a heart twisted around like that might get a thrombosis or how he might, all of a sudden, get a pulmonary edema. We will let him stay as he is at present. The adhesions may disappear later, if they are not too thick, but there is no way in which we can stop them.

October 27, 1915.

Dr. Preble: Do you remember the physical signs this boy showed a week ago?

Dr. F.: He did not show any dyspnea, the heart-beat was to

the right of the sternum, the left side of the chest was more prominent than the right, and the right side moved more in respiration. The heart-beat was absent on the left side, cardiac dulness was well over toward the right, and the breath sounds were absent over the left side.

DR. PREBLE: What is the explanation of those symptoms; what do they lead us to?

DR. F.: Those signs led us to the belief that there was something there that decreased the breath sounds.

DR. PREBLE: That there was something wrong with that left side which brought about displacement of the heart well over toward the right. What might that be?

DR. F.: We would have to think of something pulling or pushing the heart over.

DR. PREBLE: If something pulled the heart over, what effect would that have upon the left chest?

DR. F.: It ought not to make much difference.

DR. PREBLE: No, the percussion note and other findings ought to be pretty nearly normal.

DR. F.: So it could not be something pulling it over, but something pushing it over.

DR. PREBLE: And it might be either fluid or some solid body, or—can you think of anything else?

DR. F.: It might be gas.

DR. PREBLE: Yes; if gas or air were under sufficient pressure it would give just the same physical signs. That very seldom happens, but it does occasionally. Now which is it most likely to be of these three—gas, fluid, or a solid body?

DR. F.: The most likely thing would be fluid.

DR. PREBLE: Why do you say that?

DR. F.: Because a pneumothorax is a rather uncommon thing.

DR. PREBLE: Not so very uncommon; we don't see it every day, but often enough. Why do you say fluid is the most likely?

DR. F.: Because it is the most frequent cause.

DR. PREBLE: Of course, it is by far the most common, so that naturally you think of fluid because that's an everyday occurrence. What would be the next most common, Dr. E.?

Dr. E.: I think the next most common would be a solid body.

Dr. Preble: Of course that means—what?

Dr. E.: A tumor.

Dr. Preble: And neoplasms in the pleura are not so very common. One would say that the next most common thing would be gas, although gas rarely gives a dulness, it usually gives a tympany. To have gas give you precisely these physical signs would be more uncommon than a tumor. Fluid is many, many times more common than the other two causes put together, possibly twenty or thirty times more common. Can you tell simply from the physical signs whether it is fluid, solid, or gas?

Dr. E.: Usually, but not always.

Dr. Preble: Correct, and we don't hesitate very much in forming our conclusions here because of the great preponderance of fluid in these cases. What would be the next step?

Dr. E.: A puncture to determine the presence of the fluid.

Dr. Preble: Yes, an exploratory puncture. For what other reason do we make a puncture?

Dr. E.: To determine the nature of the fluid.

Dr. Preble: Why?

Dr. E.: To see whether it is malignant or tubercular.

Dr. Preble: We want to investigate the nature of the fluid in order to determine, if possible, the nature of the pathologic process that lies back of it. Before we made that puncture did you have any opinion as to what that fluid probably was?

Dr. E.: It was hard to tell in this case because the previous history did not give any clue.

Dr. Preble: Here was a boy who was taken acutely ill, with a high, irregular temperature, accompanied by chills. What would be the rather natural suspicion?

Dr. E.: Tuberculosis.

Dr. Preble: No matter what the nature of the fluid is, the physical signs will not differ essentially, whether it is serous, serofibrinous, or purulent. But here was this acute onset with a chill and then a period in which he had a pretty irregular, high

temperature, going up to 103° F. What could be the rather natural conclusion?

DR. E.: An empyema.

DR. PREBLE: Yes, that was rather my inclination; I expected that we would find an empyema there because of the acuity of the onset, the high, irregular temperature, and the sweating. None of these things, nor all three together, justify the belief that it *must* be an empyema, but it was very suggestive, and I rather expected we would get pus. Is it rather an unusual experience to find such an accumulation of fluid as that in an empyema? Of course, the usual type of empyema is that which follows pneumonia, and the fact that he had no cough rather spoke against his having had pneumonia. But he might have had a pneumococcic empyema, which could give you the symptoms just as well. So before we did the puncture, my thought was that it was an empyema. Then what did we get when we put the needle in?

DR. E.: A blood-tinged fluid.

DR. PREBLE: A blood-tinged fluid which coagulated so rapidly as to interfere with the laboratory examination. The only examination they were able to make was the bacteriologic, and the fluid was sterile. What is the most likely pathologic process lying back of that?

DR. E.: I would think of tuberculosis.

DR. PREBLE: Why do you think of that?

DR. E.: The blood-tinged fluid speaks either for neoplasm or tuberculosis.

DR. PREBLE: The reason you think it is tubercular is because the great bulk of them are tubercular. While neoplasms do occur, on the whole they are rather uncommon, but tuberculosis is very common; it is an everyday occurrence. To be sure, it is not often that we see the fluid in such quantity as it was here; usually something is done to remove it before then. Now let's see what his findings are today; it was a week ago that we saw him first.

DR. E.: The pulsation to the right of the sternum does not seem so far over as it was.

DR. PREBLE: No; we can still see the pulsation to the right

of the sternum, but it is not so far out; it is close to the sternum, and here in the right nipple line we can't see it at all; so that, upon inspection at least, one would infer that the heart had gone back toward the left side, though not completely. Can you notice any other difference on inspection?

DR. E.: The left side is moving considerably more than it did.

DR. PREBLE: Yes; although the movements are not yet symmetric; still there has been a considerable change in the motility of the two sides. Is there any difference in the size of the two sides as compared with a week ago?

DR. E.: The left side seems smaller than the right now.

DR. PREBLE: It seems to me that the left side looks smaller than it did a week ago; the intercostal spaces are better defined than they were a week ago. See if you can feel any difference, Dr. A.

DR. A.: Vocal fremitus is good down to about the third rib.

DR. PREBLE: Can you get it below that?

DR. A.: Very little.

DR. PREBLE: That is, that while a week ago one could get no vocal fremitus except just under the clavicle, one can now feel a vocal fremitus clear to the base of the lung, although much diminished when compared to the right side. We have these alterations in the physical signs—the heart is no longer as much displaced as it was, the left chest is moving more freely than it did, the vocal fremitus has reappeared over the left side, though it is much less than it should be. Percuss that, Dr. H., and see what the findings are.

(Dr. H. percusses and outlines area of dulness.)

DR. PREBLE: That looks very different from a week ago, doesn't it? It was then much further over to the right and the entire left side was dull. Now, on percussion, we find that the cardiac dulness has withdrawn toward the left to a material degree, and instead of finding dulness up to the clavicle, as we did a week ago, there is an area of hyperresonance down to the fourth rib; it is almost tympanitic over that area. Why should that be?

Dr. H.: Could it be due to compression of the lung below?

Dr. Preble: Above the compressing body we have an area in which the lung is relaxed, and as a result of that we get a note that is definitely hyperresonant, due to the relaxation of the lung. That occurs regardless of what produces the relaxation. For instance, in pneumonia one of the first evidences that the disease is disappearing is that area of resonance. And one can now, which we could not a week ago, pick out the left border of the heart. A week ago it was completely fused with the fluid dulness. Listen to that, Dr. F. What do you think about all these changes in a week, Allen?

Dr. A.: It seems to me that he is getting better rapidly enough so that another puncture won't be necessary.

Dr. Preble: Yes; the changes are very striking for a week. It is rather unusual to have that amount of change in so short a time.

Dr. E.: Why would it not be just as well to take the fluid out; is it because you want to leave the lung compressed and keep it quiet for a while?

Dr. Preble: A week ago the indications were very strong for aspiration. You are influenced very largely in that by the amount of fluid present, and then sometimes slow absorption becomes an indication for puncture, but it is going so rapidly now that we say what's the use?

Dr. E.: I was thinking that taking out the fluid would hasten the recovery just that much.

Dr. Preble: That does not always follow; it sometimes hastens a reappearance of the fluid. Unless it is considerable in amount it is just as well to leave it alone; if it disappears by absorption it is likely to be much more permanent. The absorption here has been very rapid. Even the day following the aspiration, when we removed such a small amount, there were marked evidences of improvement. We now find, on auscultation, that the breath sounds have returned clear to the base line. Posteriorly we get, just as we did in front, hyperresonance down to about the level of the fourth dorsal spine and below that dulness, although nowhere is the dulness so absolute as it was a

week ago. The breath sounds are transmitted and vocal fremitus can be felt, although much less in degree than normal.

Last Wednesday evening the temperature was 103° F.; the next day 99° F. in the morning, 102.4° F. in the afternoon; the next day from 100° to 102.4° F.; then 99.2° to 102.2° F.; this morning the temperature has been 98.6° to 99.8° F. The bowels are regular, the urine negative. There are 3,180,000 reds, 8700 whites, 62 per cent. hemoglobin; the fluid was sterile. Does that prove anything?

Dr. E.: No.

Dr. Preble: No; the probability is that the fluid is tubercular; how would we settle that?

Dr. E.: By injecting a guinea-pig.

Dr. Preble: Yes, but unfortunately the fluid was coagulated when it reached the laboratory. Now we'll take Joe in and screen him again and see what that will tell us. (Patient fluoroscoped.)

You can all see under the screen that the heart has gone back toward the left and the amount of opacity in the left lung is very much reduced, and we observe some movement of the left diaphragm. His general condition has improved to a very marked degree within seven days. The task we have in a boy like this is to discover, first, if there is fluid in the thorax, then what the nature of that fluid is, then to discover what the etiology is. The discovery of the presence of fluid and the nature of it—that is, whether it is serofibrinous, serous, or purulent—merely requires the introduction of the exploratory needle. The etiology is not so easy to prove. The probability is that the fluid is tubercular. One of our common errors—and this is true not only of tuberculosis of the pleura, but of tuberculosis everywhere—is that doctors are too unwilling to make that diagnosis. They want proof, and it is wrong to wait for absolute proof. Suppose that in this case a guinea-pig could have been injected; we would have to wait four to six weeks before we would have the proof, and then, supposing the guinea-pig showed nothing, we could not conclude positively that it was not tuberculosis. Even if the guinea-pig showed no tuberculosis we would not say it was not

tuberculosis unless, in a case like the colored woman whom we saw Saturday, the probabilities are that it is a neoplasm instead of tuberculosis. In instances where there is a little incipient cough associated with such findings it is far better to call a few of them tuberculosis that are not tuberculosis than to miss calling them. I think we can say without hesitation that in this boy we have a tuberculosis of the pleura with fluid on the left side. Now what are we going to do with a boy of that kind?

Dr. A.: Keep him in bed until the fluid has disappeared.

Dr. Preble: What you are going to do is determined by the amount of the fluid. Sometimes there are strong reasons for aspirating and sometimes not. How are you going to determine that?

Dr. A.: Aspirate those that seem to have difficulty in breathing.

Dr. Preble: If you confine your aspirations to those who have dyspnea you are not going to aspirate many of them, because dyspnea is no part of the picture. We aspirate only when the fluid becomes excessive in amount or when we have reason to believe there are other things present. You could see it no more strikingly than in this boy, with his chest just as full of fluid as it could be, and yet he was not dyspneic.

Dr. A.: I should think it would be indicated where the mechanical pressure of the fluid interferes with the return circulation.

Dr. Preble: Dr. E., what would lead you to aspirate?

Dr. E.: Slowness of absorption.

Dr. Preble: Yes; if the fluid is so slowly absorbed that you fear the lung will be compressed too long. If at the end of three or four weeks there is no sign of absorption you should aspirate. So that is one indication for aspiration even though the fluid is not excessive. Does the puncture in those cases serve any other purpose?

Dr. A.: It often seems to stimulate absorption.

Dr. Preble: Yes, we see that right along. How are we going to determine how excessive the amount of fluid is?

Dr. A.: By its effect upon the heart sounds.

DR. PREBLE: If he should begin to show evidences of cardiac failure?

DR. A.: Evidences of edema, *i. e.*, pressure on the return circulation.

DR. PREBLE: I would not want to go so far as to say that never occurs in tuberculosis, but I have never seen one in a tubercular case. I would look with great skepticism upon a diagnosis of tuberculosis where there was edema of the chest wall and the arm. The determining factor usually is the quantity of the fluid. How are you going to measure that?

DR. A.: The only way to measure it would be to remove it.

DR. PREBLE: But if the measurement is going to constitute the reason for withdrawal?

DR. A.: The displacement of the viscera.

DR. PREBLE: But suppose it was a right-sided pleurisy, then what?

DR. A.: It would be the same thing only you would have displacement of the liver.

DR. PREBLE: The estimation of the amount of fluid in right-sided pleurisy is much harder than in left sided, because the great determining factor is the effect on the heart. Now how accurate this is I can't tell you, but in a general sort of way if the apex-beat is displaced forward to the left border of the sternum, and the cardiac dulness comes to the right border of the sternum, there is generally about 1200 to 1500 c.c., and if the dulness comes over to the right nipple line there is probably 2000 to 2500 c.c. Of course, the more the heart is displaced, the greater the amount of fluid. If the heart lies to the right of the sternum the indication exists for aspiration. On the right side the estimation is much more difficult to make, and we have to determine it by the border of the dulness. If the dulness extends to the fourth rib and around to the scapular spine behind, go ahead and aspirate; if the fluid becomes excessive we are apt to have a pulmonary edema or a pulmonary infarct, so that it becomes a real danger. Why did we not aspirate this fellow? We made only an exploratory puncture.

DR. A.: He did not seem to be in any very great distress.

Dr. Preble: That should not be an influencing factor particularly. If they are in distress, all right, but whether they are or not, you should not wait too long. Here we had every indication for aspirating 1000 c.c., why didn't we?

Dr. A.: His general condition was very good.

Dr. Preble: Off and on; but what we did was just to make an exploratory puncture. The real reason was that the apparatus went to the bad and by the following day the absorption was so rapid that we said let's wait. The exploratory puncture, or the rest in bed, or something had brought about such rapid absorption that we have let him alone, and here you see him at the end of a week without having been aspirated, and very greatly improved in every way, but you will never see a case that needed aspiration any more than he did. What else should we do for him, Dr. H.? Having set aside our determination to aspirate that fluid, what can we do to hasten the absorption?

Dr. H.: Treatment on general lines; try to increase his vitality and give him a diet that will build him up.

Dr. Preble: What would you think, Dr. F., was the best thing?

Dr. F.: To eliminate as much of the fluid in the body as possible with diuretics and cathartics.

Dr. Preble: Decrease the intake of fluid and increase the output. How are you going to decrease the intake?

Dr. F.: Give him water real often, but just a little at a time.

Dr. Preble: Put him on limited quantities of fluid and on a rather dry diet. Cut down the fluid intake as much as possible. How much are you going to let him have; how much would he ordinarily take?

Dr. F.: A couple of pints or possibly 4 pints.

Dr. Preble: I think you would find that it would probably figure up to about 4 pints, including water, coffee, and tea; it would amount to about 2000 or 3000 c.c., although some probably take less. He, perhaps, takes about 2000 c.c. ordinarily; we have cut him down to 1000 c.c. Sometimes we cut them lower than that, but Joe is limited to 1000. Then what do you do to stimulate his excretion?

Dr. F.: Put him on salines.

Dr. Preble: He has been having the salines, and he had one or two doses of elaterin, but that disturbed him somewhat.

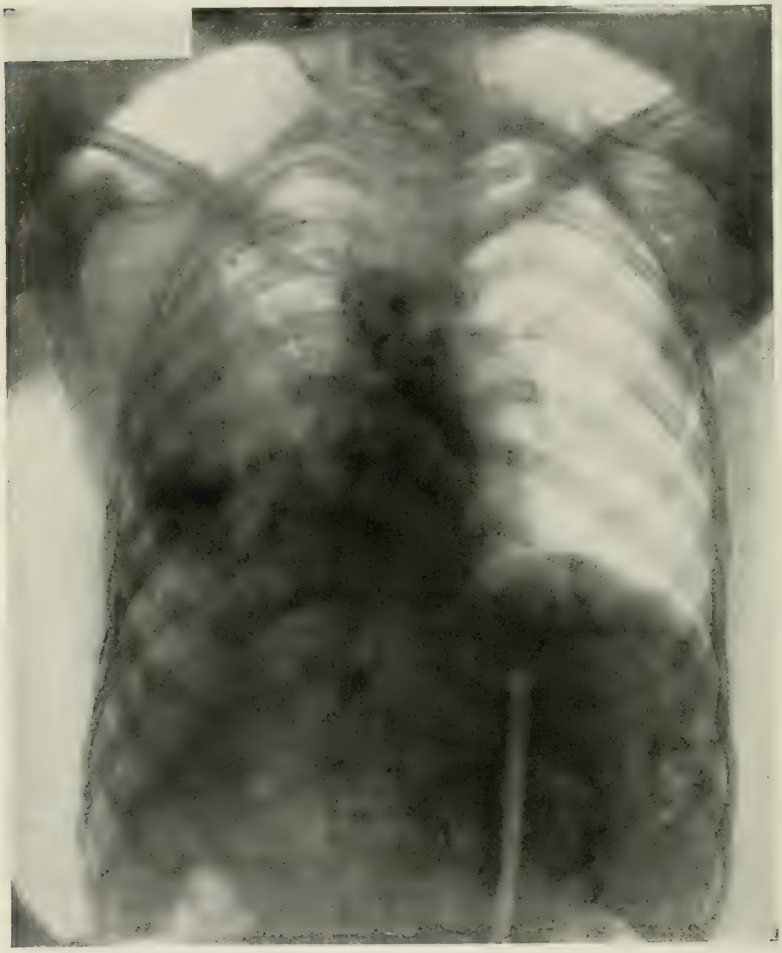


Fig. 134.—Pleurisy with effusion: *x*-ray showing lessening intensity of shadow in left pleural sac and the withdrawal to approximately its normal position. Taken three weeks after Fig. 133.

The salines are more often used. Would you sweat a boy like that?

Dr. F.: I don't think so, because it is apt to weaken him.

DR. PREBLE: I wouldn't do it, not so much on account of the weakening, but because it might bring on an attack of dyspnea. How long does it take generally for a fellow like this to clear up?

DR. F.: I should say about a month.

DR. PREBLE: That would be a short time; he has been improving very rapidly, but it does not follow that he is going to continue to do so. It will be at least several weeks—that's a safe estimate—for it takes a long time to clear them up completely. Then what are you going to do when he gets in shape to leave the hospital?

DR. F.: Advise him to stay outdoors as much as possible and get plenty of fresh air, and—

DR. PREBLE: What you are trying to tell me is that you would take care of him just the same as you would any other case of tuberculosis. That the ordinary rules that are going to guide you in any case of tuberculosis are going to guide you here. He is doing general office work, what do you think about that?

DR. F.: I think he ought to have some outside work.

DR. PREBLE: Of course. What he ought to have is a year or two of just doing nothing, but in his circumstances that is out of the question. He ought to have outside work if possible.

DR. F.: How about the primary focus of infection?

DR. PREBLE: Where it may be we can't tell so far. We may be able to find it after the fluid disappears, but now we can't tell. Many times we never can tell. He shows no evidence of tuberculosis in any other portion of his body, but after he gets straightened around maybe we can find it.

UNILATERAL EDEMA WITH PLEURAL AND ABDOMINAL EFFUSION DUE TO PAPILLOMATOUS OVARIAN CYST. DYSPNEA USUALLY PRONOUNCED IN MALIGNANT PLEURISIES

October 23, 1915.

DR. PREBLE: What were the physical signs in that young boy we saw three days ago, Dr. Henderson?

DR. H.: The most noticeable things were the heart on the right side, the increased breathing on the right and none on the left, the loss of vocal fremitus on the left; on auscultation we found no breath sounds on the left, increased a little on the right; he was having no pain at that time and there were no heart murmurs.

DR. PREBLE: That is, we found the evidences of a large accumulation of fluid on the left side with a cardiac displacement, and we made a not too successful aspiration and obtained some blood-stained serum. I thought I would bring you up here this morning and show you this woman who has been in only a few days. She tells us that about three years ago she began to have some pain in the right side of her abdomen; this bothered her slightly, and after a while she went to a doctor, who told her that she had a fibroid of the uterus. However, she kept on going back and forth and round about until about a month ago. For a period of about three years, in spite of this fibroid tumor of the uterus, she went on doing her work. She began to fail about a month ago, and at the same time noticed that her left leg commenced to swell. Then she began to get short of breath; she has been in bed since the onset of the dyspnea. During all that three years she has been losing some weight; she does not know just how much. She weighed 165 to start with, and a few months ago she weighed 150; how much she has lost since then we don't know, but she has been losing weight more rapidly in the last month. Have you had any pain at all, Mrs. B.?

PATIENT: No, I don't have pain.

DR. PREBLE: She is weak, tired, and out of breath, and that's her story. (To Patient): Now can you turn over on your

back for a few minutes? She doesn't like to lie on her back because she can't breathe so well. How does it disturb you, Mrs. B.?

PATIENT: I can't lie very long this way because I can't get my breath.

DR. PREBLE: Now what do you notice on looking at her?

DR. B.: She is dyspneic.

DR. PREBLE: Yes, she is dyspneic, and it is not altogether dependent on position, but she breathes much better if she is lying on her side. What other things do you notice?

DR. B.: The respirations are rapid, not deep.

DR. PREBLE: What do you think, Dr. H.?

DR. H.: I think the respirations are more marked on the right side, but the most remarkable thing is the difference in the size of the breasts.

DR. PREBLE: That's the thing that strikes me, and not only that, but this left arm is larger than the right.

DR. B.: The lower part of the thorax seems to be fuller.

DR. PREBLE: That may be in part due to the difficulty in breathing; but the most striking thing about it is that there is a good deal of difference in the size of the breasts—a considerable increase in the size of the left breast and of the tissues above and of the arm. Then, of course, one notices the dyspnea; the breathing on the right is more conspicuous than on the left. Can you see any pulsation there? (indicating right breast). While you can't see the cardiac impulse, you can feel it in the right mammary line. On percussion, as we come down along the right border of the sternum, we run into an area of dulness at the fourth rib, and that dulness curves out and joins with the liver dulness, about $2\frac{1}{2}$ inches to the right of the median line. This area on the right is all resonant, front and back, perhaps hyperresonant, but on the left there is absolute dulness over the front and back, and if you listen you will find that the breath sounds are lost over the left side. So we have the same thoracic findings that we had in the other case—absence of breath sounds, cardiac displacement, and a great big area of dulness; percussion of the cardiac area confirms the findings by palpation; vocal fremitus is present on

the right side, while it is lost on the left. That leads us to what conclusion?

Dr. B.: To about the same conclusion as the other case.

Dr. Preble: Yes; that we have something in that thorax which is displacing the lung and the heart and, of course, the common thing is—what?

Dr. B.: Fluid.

Dr. Preble: Yes; but in what way does this case differ?

Dr. H.: This patient is dyspneic.

Dr. Preble: Yes; here is a patient whose physical signs are no more pronounced than those of the boy we saw Wednesday, and yet she is so dyspneic that she is very uncomfortable, and we have to accommodate our examination to her symptoms and let her lie on the left side, because in other positions she suffers too greatly from dyspnea. What other difference is there?

Dr. B.: The history of the onset is altogether different. This condition has been going on for three years and started with a fibroid.

Dr. Preble: No; she says that three years ago she had pain in her abdomen and somebody found a fibroid in the uterus, but she went right on and did her work as usual, and it is only recently that she has had this difficulty, just about four weeks. Now let's talk about the things that are present in the thorax: the dyspnea is one thing, and what is the next most striking thing?

Dr. E.: The asymmetry of the chest.

Dr. Preble: The edema of the left chest and arm. That varies somewhat; in addition to dyspnea, we have edema of the left thorax and the upper arm. The hand and forearm are free from edema, but the arm is edematous, and particularly the left breast. Now are there any other differences?

Dr. E.: I can't think of any.

Dr. Preble: There is at least this difference: during the short period that she has been under observation (only a few days) her highest temperature has been 100° F., but the boy's temperature went up to 103° F. and a fraction. This woman is

practically afebrile, while the boy had a high temperature. Then there are other differences also.

DR. H.: She has lost considerable weight.

DR. PREBLE: That's another; this patient has been sick for about a month and has lost a lot of weight; the boy has been sick for about the same length of time and has lost very little, and yet the boy has been running a high temperature and she is practically afebrile. She feels sick, but the boy didn't feel very bad and feels better now.

DR. H.: She has an irritative, unproductive cough, and that may mean irritation of the vagus.

DR. PREBLE: There is one other thing I want to show you. There is edema of the entire left leg and there is edema in the lower chest wall. Now what can we do with all these symptoms; what do you think about it, Dr. S.?

DR. S.: I have not come to any conclusions.

DR. PREBLE: Up to a certain place the thing runs smoothly enough; the physical signs are all those of either fluid in the thorax or a great big solid tumor. Of course, the chances are all in favor of its being fluid, and, as a matter of fact, we know that the thorax does contain fluid because an exploratory puncture was made. But why should she be so dyspneic? So far as the quantity of the fluid is concerned, she is no worse off than that boy—that's one thing; then the next thing, why the edema?

DR. S.: Couldn't the dyspnea be explained by the fact that it might be a malignant affair in the lung?

DR. PREBLE: Yes, oftentimes. That is, if the cause of your transudate is a neoplastic process rather than an inflammatory process, then we have dyspnea way out of all proportion to what the physical signs would indicate, and while an individual might have dyspnea from an inflammatory process we would not expect it to be so severe. But if dyspnea is due to some neoplastic affair then it may result from a variety of conditions. So the extent of the dyspnea suggests that we have to do with a very different process from that of the boy downstairs. How about the edema, Dr. E.?

Dr. E.: The edema makes me think of the heart and kidneys.

Dr. Preble: It is a unilateral edema and it is not confined to the thorax; it is in the leg as well. The right side of the body is free from edema and the left side is edematous. One of the first things she noticed was that the left leg was swelling. How could she have a unilateral edema? First she had an edema of the left leg, and then began to feel weak and tired and short of breath, and had to go to bed. The examination of the abdomen shows that the lower part is occupied by a great big tumor mass which is irregular in outline, and which Dr. Williams, who has examined her vaginally, thinks is not a fibroma. But she has a large, irregular, hard, nodular mass which occupies the lower half of the abdomen, and there is some free fluid in addition.

Dr. B.: You could explain that by pressure down there and metastasis in the lung, couldn't you?

Dr. Preble: Of course, one is struck by the difficulty in explaining a unilateral edema, because it is not possible for one vessel to give a unilateral edema; in addition to edema of the leg there is edema of the chest.

Dr. H.: What was the nature of the fluid that was removed?

Dr. Preble: There is no report on it yet, but it was a straw-colored fluid.

Dr. H.: It might be pressure.

Dr. Preble: That thought occurs to us, that we have pressure on the iliac and a secondary process that gives rise to the edema of the chest and arm. If we had a tumor of any sort up in the mediastinum, growing irregularly and irregular in shape, it would give us edema of the breast and then involve some of the branches of the subclavian and possibly give edema of the arm.

Dr. B.: Do you look upon edema as obstruction of the veins or the lymph channels?

Dr. Preble: It is almost always caused by obstruction of the veins.

Dr. S.: Can you get an edema without a cyanosis?

DR. PREBLE: The cyanosis would not show up very well on this colored woman, but the edema shows.

DR. S.: Her position on the left side would account for a little of it, wouldn't it?

DR. PREBLE: That is the thing that strikes us—the edema is all on the dependent part: the left breast, the left leg, the left arm; the right side is free. Can it be that that is a purely mechanical edema?

DR. E.: I don't think it would be as pronounced as that?

DR. PREBLE: Could she get such an edema as that from just a cardiac weakness?

DR. E.: She had the edema in the left leg before she went to bed.

DR. PREBLE: If the edema in the left leg was cardiac in its origin you would say she must have it in both legs, unless there was some obstruction in a vein. Here we can say her heart began to fail and there was not enough return circulation on the left side, so she very easily developed an edema there, but the circulation on the right was all right, so she got no edema there; when she was up and about of course the leg was the lowest portion of the body, but when she went to bed the lowest plane became the left side of the body. If you take just the arm you will see that there is more edema on the back of it than on the front. We can assume that she has both weakness of the heart and some obstruction of the veins on the left.

DR. H.: Is there any edema at all on the right side?

DR. PREBLE: I haven't seen any. What other evidences have we of cardiac failure? If that edema is due to cardiac failure and the influences of position we ought to have some other evidences of decompensation.

DR. B.: The respirations are weak and rapid and there should be hepatic or splenic enlargement.

DR. PREBLE: I could not find that the liver was enlarged because of the abdominal involvement. These people are not very observant, and it is quite possible for her to have had a heart lesion which did not give rise to any disturbances and then all of a sudden broke. It did not start like a broken compensation,

and the dyspnea can be accounted for on the basis of the fluid; if that edema was due to cardiac weakness, even though she lies on the left side all the time, why should it not be present on the right?

Dr. B.: It should appear on the right side.

Dr. Preble: Yes, it should; that is, while one often will see irregular distributions of edema due to mechanical factors, where the edema is due to the heart we ought to find it bilateral. Even as she lies here there is not much difference in the position of her two legs, and yet the one is markedly edematous and there is nothing left of the other but skin and bones. It does not seem to me that the edema is due to cardiac failure, but that it is due to interference with the return circulation. The ordinary tubercular pleurisies do not give this clinical picture at all, but neoplasms do.

Dr. H.: How long has she had that cough?

Dr. Preble: For about two months. If we say that is a neoplasm, then what is the possibility? Is it a primary thoracic affair or a metastasis? The ordinary sequence would be that along about three years ago she developed what was probably a fibroid of the uterus; I don't say that because that was the diagnosis at that time, but because these fibroids are such common affairs and occur with such great frequency; then she went on without much difficulty until about five weeks ago, when these other symptoms appeared. She became weak and tired, the edema of the leg appeared, and later the edema of the breast. Probably the fibroid went on month after month, as they often do, and then all of a sudden they undergo malignant degeneration and we get an exudate into the abdominal cavity and the pleural cavity and eventually metastases in the mediastinum.

Dr. B.: Does she show any glands?

Dr. Preble: No, we can't feel any.

Dr. H.: Has the fluid accumulated very fast?

Dr. Preble: The only puncture that has been made was an exploratory one. (To Patient): When did Dr. Williams put the needle in, Mrs. B.?

Patient: Two weeks ago.

Dr. H.: It may be that she has a metastasis in the liver.

Dr. Preble: Of course, that may easily have developed; we don't know. She has some fluid in the abdomen, but it may be that this fluid is an exudate, not a transudate. Dr. Williams is going to aspirate and remove some of the fluid and this will be sent to the laboratory for examination.

Note.—The fluid aspirated showed a specific gravity of 1017, albumin, 6 per cent.; 267 cells per cubic millimeter, mainly lymphocytes.

This patient was aspirated one week later for the second time and fluid of the same character withdrawn.

A few days later the abdomen was opened and a fairly large papillary cyst of the left ovary with invasion of the peritoneum was found, and the tumor removed.

There seems no reason to question the diagnosis of secondary intrathoracic metastases.

CLINIC OF DR. MAURICE L. GOODKIND

MICHAEL REESE HOSPITAL

A FULMINATING CEREBROSPINAL MENINGITIS DUE TO THE PNEUMOCOCCUS

The Nose the Atrium of Infection. Onset with Wild Delirium, Terminating in Death in a Few Hours

TODAY your attention is directed to a patient suffering from a malady which will require all your diagnostic acumen and skill in order that you may correctly interpret same.

He was brought to our hospital today in the condition in which you now see him, wildly delirious and incapable of responding to any questions directed to him. His friend, who accompanied him to the hospital, informs us that, as far as he is aware, the young man has never been ill, with the exception of a fall which he sustained several years ago and of which he had apparently fully recovered after a few weeks. The friend, furthermore, tells us that the patient retired, apparently in excellent health, Saturday night—that is, October 9th—but on awakening in the morning he complained of a headache which increased exceedingly in intensity toward evening, at which time he also vomited (no information available whether this vomitus was of the projectile type or not). He was somewhat depressed, but retired quite early Saturday night. At four o'clock this morning (October 11th) he was found breathing very heavily, and apparently wildly delirious.

As we examine our patient we find that he is an exceedingly well-built, well-nourished young man, apparently about twenty years of age. He struggles so violently that he requires restraint. He is breathing stertorously, and is almost totally oblivious to his surroundings, although he seems to be perturbed by sound and by light (phonophobia and photophobia).

His pulse-rate is 88, of increased resistance, with a systolic pulse pressure of 160, rectal temperature 104.6° F.; noisy, irregular, stertorous respirations; blood showed a leukocytosis of 24,000, of which 95 per cent. were polymorphonuclears.

We further observe that his head is sharply drawn back on his pillow (opisthotonos); that his torso is somewhat arched anteriorly (emprosthotonos). On attempting to flex his head toward his chest we meet with very firm resistance, and at the same time note that the legs become flexed upon the abdomen (Brudzinski), which we consider a very valuable criterion or sign of meningeal inflammation.

On attempting to extend the legs, which we have flexed at the knees upon the trunk, we meet with a very firm resistance which we are unable to overcome (Kernig).

On stroking the soles of the feet we have dorsal flexion of the big toe and simultaneously plantar flexion of the remaining toes (Babinski). This condition is also produced by firm downward stroke along the anterior and posterior surface of the legs (Oppenheim and Gordon signs). Also a firm pressure exerted somewhat beneath and posterior to the internal malleolus produces the same phenomenon (author's sign).

Reflexes.—We find the biceps, triceps, periosteal, radial, and knee-jerks normal; no ankle-clonus; the cremasteric and abdominal somewhat sluggish.

The pupils are irregularly contracted, react sluggishly to light; very marked outward deviation of the left bulbus. No nystagmus or eye-ground changes found. No subconjunctival hemorrhages.

Examination of the ears yields no result (purulent discharge, mastoid tenderness).

The skin is somewhat cyanotic; there is no eruption, no taches, no dermography, nor do we find petechia or herpes. Some importance may be attached to the presence of herpes in certain acute infectious diseases, as it is so frequently associated with pneumonia, cerebrospinal meningitis, and malaria.

Examination of the chest and abdomen yields negative results.

We have, then, before us a picture of an individual who apparently has been in perfect health until yesterday, but today exhibits very manifest symptoms on the part of the cerebrospinal system. We not infrequently find (and this is predominantly so in children) that at the onset of many acute infections a similar array of symptoms may obtain. We have observed it frequently in pneumonic inflammations, especially in involvement of the upper right lobe, so that the signs of a pulmonary invasion may be entirely masked, unless revealed by a careful physical examination and the picture of a meningitis prominently presented. We have also observed a similar resemblance in a number of cases of polioencephalitis (meningeal irritation or meningism).

Let us now attempt to unravel the cause of the cerebrospinal-meningeal inflammation from which this man is suffering. Is it a tubercular process? Or is the infection due to a purulent focus in the neighborhood of the meningeal membrane (ear, mastoid, sinus)? Or is a more remote pyogenic focus the source of the infection carried to the cerebral sphere (ulcerative endocarditis, abscess of the liver, thrombophlebitis, bronchiectatic process)? Or, as a result of the fall, has he been suffering from a cerebral abscess in the latent part of the brain tissue, which has now broken into the meningeal region?

Concerning a tubercular infection, we find that the onset is very acute, also the absence of any tubercular focus, and the presence of a very high white blood count. The Macewen sign, considered by the author to be of considerable value in meningitis, especially of tubercular nature, consists in a tympanitic note, obtained by percussion over the inferior frontal or parietal bones. Personally, I have had but little success with this test. Nor do we find anything to justify the assumption of a pyogenic infection from a remote organ (bones, veins, heart, liver, lung, etc.).

There are no ear findings present (mastoid or ear discharge), and, while the infection may come from one of the sinuses, we have no history to that effect (colds, pressure headaches, occasional chills and fever). But no examination should be regarded

as complete until the sinuses have been thoroughly examined by a specialist through transillumination and röntgenograms.

Is there any other measure which will assist in determining the nature of the cerebrospinal meningitis from which this man is apparently suffering?

Quincke has answered that question for us. Now we shall proceed in accordance with the method devised by him, and make use of a measure which we firmly expect will clear up the situation. We shall now introduce a needle in the subdural space between the fourth and fifth lumbar vertebra in the median line, directing the needle slightly upward and inward to a depth of 5 or 6 cm., and as we do this we note that the fluid emerges under slightly increased pressure—175 mm. of water (normal being about 130). The fluid is turbid, and on being subjected to the various globulin tests (Pandy, Ross-Jones, Noguchi, and Nonne) gives a very decided positive reaction. Lange's gold chlorid test presents a typical meningitis curve. On examining the cells we find a very marked pleocytosis of a polymorphonuclear type, there being 2000 white blood-cells per cubic millimeter, 100 per cent. polymorphonuclear.

These findings in themselves thus far would exclude tuberculous meningitis, serous meningitis, meningism, and narrow the diagnosis down to the cerebrospinal form, which may be due to Diplococcus intracellularis meningitidis (the so-called epidemic cerebrospinal meningitis), or the pneumococcus, streptococcus, staphylococcus, or the influenza organism.

From the apparent absence of pyogenic infection, the acute onset, and course of the disease one may conclude that the differential diagnosis lies between the Diplococcus intracellularis and the pneumococcus type. Again, these two organisms are, by all odds, the most frequent cause of cerebrospinal meningitis. The absence of lung findings, the acute fulminating onset, the very pronounced rigidity of the neck, which Osler maintains is very rarely present in the pneumococcus type, would rather incline one to the impression that we are dealing with a sporadic case of the epidemic form of cerebrospinal meningitis.

In order that valuable time may not be lost while the bac-

terial tests are being conducted, it is a wise plan, as in a case of suspicious diphtheritic membrane of the throat, to institute therapeutic measures while awaiting the laboratory results.

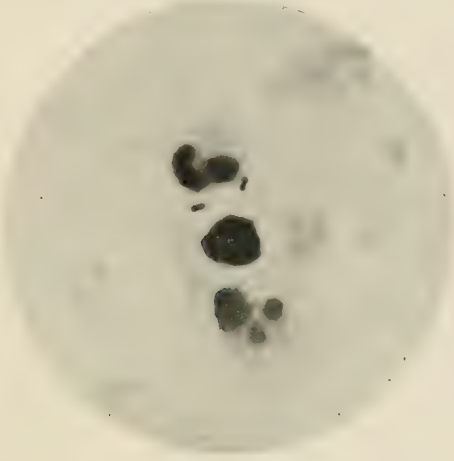


Fig. 135.—Acute meningitis, showing cerebrospinal fluid with pus cells and pneumococci. (× 1200.)

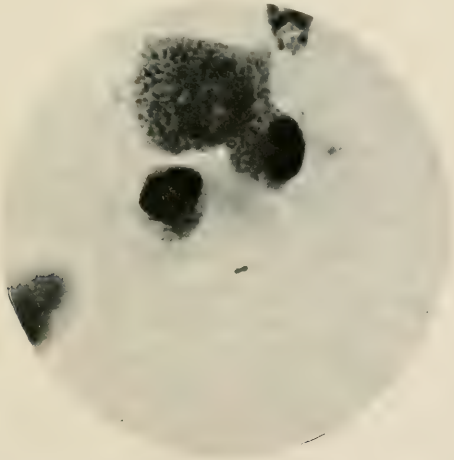


Fig. 136.—Acute meningitis, showing pus from ethmoid sinus, containing pus cells and pneumococci. (× 1200.)

After withdrawing 40 c.c. of spinal fluid from our patient we shall introduce a similar amount of Flexner-Jobling serum.

We can do no harm by this procedure, no matter what the organism may be that is causing this man's spinal meningitis, and if the process proves to be due to the Diplococcus intracellularis meningitidis, it is the one remedy which has proved to be of any value in this disease.

For the maniacal excitement from which this patient is suffering we shall use ice-bags to the head and along the spine, large doses of bromid and chloral by rectum, and, if these measures prove ineffective in allaying his violent excitement, we shall have to resort to morphin.

Subsequent Notes on the Case.—Four hours after admission of this patient to the hospital exitus occurred. The direct smear and culture inoculations proved the organism to be a pneumococcus, arising, in all probability, from the pus found in the cribriform plate of the ethmoid, which also yielded a pure pneumococcus organism. This condition was apparently latent for a long time and gave rise to no symptoms. An autopsy was performed on this patient by our pathologist, Dr. E. G. Kirk. A few important points from his exhaustive report may be of interest: The pia was everywhere infiltrated with pus cells and small round cells, as were also certain cortical areas. The anterior ethmoid cells and the superior nasal fossa were involved in a mucopurulent process. Direct smears from both the meninges and nasal mucosa revealed the presence of a lanceolate-shaped diplococcus. Cultures from both regions showed it to be the pneumococcus of Fränkel. Spinal fluid (5 c.c.) obtained one hour after patient's admission to hospital, injected intraperitoneally into a small white mouse, produced death in fourteen hours. Pure cultures of the pneumococcus were obtained from its heart's blood.

APLASTIC PERNICIOUS ANEMIA. ANALYSIS OF THE BLOOD-PICTURE. ADMINISTRATION OF ARSENIC AND DEFIBRINATED HUMAN BLOOD

Our next patient is a clergyman, thirty-seven years of age, whose past history of previous illnesses, habits, and heredity are absolutely unblemished. As we question him, he tells us the reason that he has come to the hospital to seek medical aid is because of *increasing weakness*, amounting at times to almost complete exhaustion. He has been suffering from this for the last three years, but during this period there have been times when he has felt fairly well (remissions). There have been three such intervals of comparative freedom from any discomfort during that time; the shortest interval being six weeks, and the longest immunity which he has enjoyed three months. In addition to this weakness, which now confines him to bed, he complains of some *dyspnea*, especially on exertion; he has had occasional attacks of nausea, complete anorexia, and intestinal upset, diarrhea alternating with constipation. He has a frontal headache most of the time of a dull aching type; he describes it as being more of a pressure than a pain. He has attacks of vertigo, flashes of light before the eyes, and tinnitus aurium. Before he became bedridden (about a month ago) he had considerable palpitation and occasional edema about the ankles on walking. He has some numbness and tingling in the hands and feet. He has lost about 30 pounds, the greater portion of which loss occurred during the last six months. Previous to that time his weight and condition of nutrition were fairly well maintained. He has never had hemorrhage from any of the emunctories. He now complains of blurred vision. As far as he knows he has never had chills, though there are intervals when he has an occasional evening rise of temperature. That, in brief, is the history which he gives us.

As we proceed to examine the man, we note the peculiar color of the skin. Through carelessness it is often mistaken for jaundice, a *lemon-yellow pigmentation*. As we examine the scleræ we find no icteroid appearance, but a pearly white

glistening color. This color of the skin is quite unlike the ashen pallor which one observes after an acute hemorrhage, nor is it like the waxy, muddy color which is found in nephritis. Although he claims to have lost 30 pounds, the subcutaneous tissue and fat seem well preserved. The muscles are flabby, but apparently not much atrophied. A very marked pulsation is seen in the veins of the neck. The pulse is large, soft, and easily compressible, systolic blood-pressure 90, diastolic 70, with a frequency of 96. His temperature is normal, but on several occasions since his sojourn in the hospital it has risen to 101° F. As he lies quietly in bed his breathing is not labored, but on the slightest exertion which he makes we observe that he becomes dyspneic and somewhat cyanotic.

The heart is enlarged, especially in its transverse diameter—8 c.c. to the right of the midsternal line and 12 c.c. to the left. The apex is diffuse and wavy.

On auscultation one hears a loud systolic murmur over the entire precordium. There are also loud murmurs to be heard as we place our stethoscope over the veins (bruit du diable). As we continue our examination of the skin we find, in addition to the yellowish discoloration, innumerable small brownish spots which do not disappear on pressure (vibices).

The lung sounds, both on auscultation and percussion, are normal.

The edge of the liver and spleen can be felt on deep inspiration. There is no adenopathy, nor do we find any bone tenderness.

He has no bladder or rectal disturbance.

He is able to move his arms quite freely, but the legs with apparent difficulty. There are irregular areas of hyperesthesia and analgesia over both legs, and, to a less degree, over the backs of the hands.

The tendon reflexes are very lively, but the tests for determination of pyramidal involvement are negative (ankle-clonus, Babinski, Gordon, and Oppenheim).

The eye reflexes are responsive to both light and accommodation, but a fundus examination reveals retinal hemorrhages.

We have no cranial nerve involvement. No evidence of stereognosis or ataxia.

The Wassermann is negative in blood and spinal fluid.

Von Pirquet is negative.

Urine.—Occasional trace of albumin and very marked urobilinogen reaction (hemolysis). No albumose.

Examination of the stools at no time revealed blood, ova, or parasites (uncinariasis, hookworm, Bothriocephalus latus, or fish tapeworm), potent causes of hemolysis.

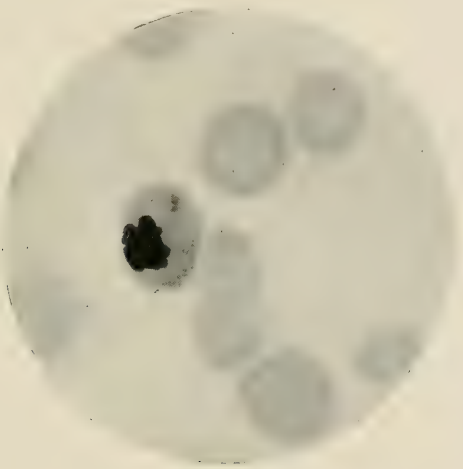


Fig. 137.—Showing five megalocytes and a megaloblast, the diameters being 15 to 16 micromillimeters (× 1200).

Blood-culture was sterile. No malarial organisms nor Filaria sanguinis hominis were found.

The blood-picture affords an interesting study. The red blood-cells are reduced to 1,200,000, hemoglobin 35 per cent., the white blood-cells 3000. So we find that the hemoglobin is not reduced in proportion to the diminution of the red blood-cells, hence a color-index greater than one. The red blood-cells appear extremely deformed and distorted (poikilocytosis). There is also a slight degree of variation in the size (anisocytosis), but not to the extreme degree that you see it in the blood taken from another patient suffering from the same disease.

In this specimen (demonstrates microscopically) are seen many red blood-cells of variable size, 2 to 20 micromillimeters (microcytes); many nucleated red blood-cells, some of normal size (normoblasts), and some between 10 and 20 micromillimeters (megaloblasts).

We also observe that the staining of the protoplasm is not uniform as in normal conditions. This nuance of colors is known as polychromatophilia. There is a basophilic degeneration of the red which causes a peculiar stippled appearance. This was first described by Grawitz in the severe anemias due to lead-poisoning.

We also find a number of large mononuclear white blood-cells with granulations (myelocytes). This reversion to the fetal type is probably due to the stimulation of the erythroblastic and leukoblastic tissues, which attempts by overactive production to counteract the effect of the hemolysis caused by the poison, whatever it may be.

We do not find these *regenerative* forms in the blood of our patient. He has 3000 leukocytes. The differential count gives us 25 per cent. polymorphonuclear, 70 per cent. of small lymphocytes, and 5 per cent. transitional. This perversion from the normal would indicate a very distinct interference with the production of the granular form of leukocyte (crippling of the leukoblastic centers).

An enumeration of the blood-platelets has not yet been made, but with the Wright stain they appear to be very much diminished in number, which may help us in explaining the slow coagulation time (ten minutes) of this patient (thrombokinase deficiency).

As we assemble our symptoms, we have a patient who is obviously suffering from a high-grade anemia, in whom there is absent all etiologic factors of secondary anemia (ulcer, cancer, recurrent hemorrhages, hemorrhoids, intestinal parasites, malaria, tuberculosis, syphilis, lead-poisoning, septic processes, nephritis, leukemia, and Hodgkin's disease). There are certain distinguishing characteristics in his case. Extreme weakness, peculiar color of the skin, retinal hemorrhages, erythrocytes below 2,000,000, increased color-index and leukopenia, which fully justifies our

diagnosis of pernicious anemia of the idiopathic type, or so-called primary cryptogenic pernicious anemia.

There is a deviation in some directions from the ordinary form—the absence of the regenerative type of blood-cells and the leukopenia. This special type of pernicious anemia is known as *aplastic anemia.* There is also a very marked difference in the appearance of the bone-marrow in these two types, the plastic form having an intensely red color, while in the aplastic anemia the bone-marrow appears atrophic and fatty.

We have had several other patients during the past year who have conformed to the type of aplastic anemia, as described by Cabot, rather more closely than our present case. They were more *youthful;* there was a *more rapid course* (one terminating in eight and the other in twelve weeks); both had extensive *necrotic processes of the tonsils and gums, with severe hemorrhage* and a *low color-index.*

This disease was first described by Addison, of Guy's Hospital, London, almost one hundred years ago. Shortly after that Biermer, of Germany, reported a series of cases, but it remained for Ehrlich to give us a clear description of the hematologic characteristics of the disease. In this country Richard Cabot has made the most exhaustive study of the disease. He has assembled some 1200 cases, of which over 300 occurred in his own practice. Much of our clearer understanding of pernicious anemia today is due to the careful analysis of his material. His classification of pernicious anemia includes only those cases of severe type of anemia in whom all etiologic factors (syphilis; malaria; lead-poisoning; menopause; atrophy of gastric tubules; gastro-intestinal sepsis; intestinal parasites; changes in bone-marrow, such as cysts, malignancy, and necrosis; chronic diarrhea; hemorrhage—whether from the nose, intestinal tract, uterus, or from any other mucous surface) can be excluded.

He has found that in 84 per cent. of his cases there was evidence of some change in the spinal cord, for the greater part in the cervical posterior columns, so that the clinical picture resembled a spastic paraplegia (Gowers' type), tabes, or peripheral neuritis. The symptoms of spinal cord degeneration may

appear before the blood-picture is fully developed. He regards the aplastic form of pernicious anemia as simply differing in degree but not in kind from the ordinary type, one in which there is no response on the part of the bone-marrow to the call for new reserves.

His tables show that the disease is twice as frequent in the male as in the female. Most often found between the ages of thirty and sixty; over half the cases occurring between the ages of forty and sixty years. He calls attention to the frequency in which remissions occur, so that the disease often is prolonged for many years. The average duration is from one to three years. He has also demonstrated that the plastic type of anemia occurs more frequently in the female, and is more rapid in its course and occurs at an earlier age.

The ordinary conception that emaciation is a rare feature of the disease is disproved by his statistics, for, while this is true in the large percentage of cases, 40 per cent. of his series had loss of weight.

A fairly large percentage of his cases showed some evidence of psychic change apart from the nervous irritability, lack of energy, headache, and insomnia, common to the general run of anemic cases. There were quite a few who had actual psychoses, mania, delirium, and especially the melancholic type of depression.

Pathology.—There is a fatty degeneration of the heart, liver, and kidneys, with an increased deposit of iron in the liver, especially in its peripheral lobules, and, to a lesser degree, this deposit of iron is also present in the spleen and kidneys. The bone-marrow shows an active hyperplasia and is of an intensely red color, excepting in the aplastic type.

Treatment.—Rest in bed, preferably in the open air and, if possible, in an altitude of 2500 to 3000 feet. Light general massage, stimulating baths (Nauheim, sea salt) are all of value.

The diet should be one that is easily assimilated and nourishing. There are many who believe that meat should be avoided because of the increased intestinal putrefaction which it may induce. Personally, I am very much in favor of using expressed

beef-juice from meat which has been sufficiently broiled on both sides to destroy parasites, and of this have the patient take a half-cupful to a cupful daily.

Careful attention should be paid to the mouth and gums.

The bowels should be evacuated daily, preferably through high rectal flushings. Some advocate the use of intestinal antiseptics in this disease. Personally, I have not obtained benefit from their application.

Bone-marrow has been given, but is now largely discarded.

Of all the remedies that have stood the test of time and experience, none has proved of as great value as arsenic. It may be administered in the form of Fowler's solution, cautiously advancing from 3 minims after each meal up to 20 minims (always in several ounces of water). It is to be withdrawn or diminished if signs appear indicating that we have reached the physiologic limit (nausea, vomiting, epigastric pain, diarrhea, puffiness of the eyelids, pigmentation of the skin, and nerve pains). A very satisfactory method of employing the drug is hypodermically. Atoxyl, arsacetin, and cacodylate of sodium have all been used for this purpose. Personally, I prefer the last-named drug. In the beginning a dosage of $\frac{1}{2}$ grain, and gradually increasing it up to 3 grains, every other day.

Iron, which is of inestimable value in chlorosis and the secondary anemias, is practically useless in this form of anemia.

I have employed subcutaneous injections of defibrinated human blood apparently with good results—25 c.c. of this defibrinated blood is injected underneath the skin of each thigh and slowly massaged into the circulation, or 500 c.c. may be administered intravenously.

There are some instances in which a direct transfusion from the donor to recipient by the Crile method is said to produce beneficial results. Certain precautions must necessarily be observed in this last method—*i. e.*, Wassermann, tuberculin, and hemolytic tests should be made before employing it.

Removal of the spleen, as in splenomegalia, has been advocated, but the procedure is of too recent date to warrant one drawing conclusions.

PRIMARY ADENOCARCINOMA OF THE MEDIASTINUM (INOPERABLE)

Description and Differential Diagnosis of Mediastinal Neoplasms. *x*-Ray Treatment in Detail

Preliminary to the discussion of the patient we shall present to your attention today, it may not be superfluous briefly to recall to your minds some anatomic considerations concerning the mediastinum and its contents.

The mediastinum is the space included between the sternum and vertebral column, extending from the root of the neck to the diaphragm, and is laterally bounded by the pleuræ and lungs. Surgically, some speak of an anterior and posterior mediastinum, the heart and its blood-vessels constituting the dividing line; others, of a superior and inferior, the superior containing all the structures above the upper border of the heart, the inferior, those below. In a fluoroscopic sense, a third division is feasible. The patient being placed in a right oblique anterio-posterior position, three distinct mediastinal spaces are apparent, the anterior, medial, and posterior. The contents of the anterior are the lymph-nodes, the areolar tissues, and the thymus or its remains. The medial and posterior contain the heart with its afferent and efferent vessels, the trachea, the bronchi, the esophagus, thoracic duct, vagus, phrenic and sympathetic nerves, and lymph-nodes.

Growths of the mediastinum may originate (1) primarily from structures within the mediastinum; (2) from contiguous organs, growths of which may encroach upon the mediastinal spaces (lungs, pleuræ, and thyroid); (3) metastatic growths from distant organs (breast, gastro-intestinal tract, especially the rectum, uterus, prostate, kidney); (4) Hodgkin's disease and the leukemias.

Growths of a metastatic origin are usually small, except in the case of Hodgkin's disease.

Rarer forms of primary growths are the fibromas, lipomas, myomas, enchondromas, dermoid cysts, echinococcus, teratomas, actinomyces, and gummas.

Of this very rare type allow me briefly to relate a case seen with Dr. Bastinelli in Rome. For eight years a man twenty-five years of age had signs of substernal tumor with symptoms of myasthenia gravis.

At necropsy the thymus was found very much enlarged with lymphocytic infiltrations. The iliopsoas muscle, the pectorales, the ocular external recti, and the diaphragm were also similarly infiltrated. From its long duration this may be clinically called a non-malignant type of sarcoma, a term to which our pathologic friends may take exception.

The more common growths of the mediastinum are the sarcomas and carcinomas. Here it is not out of place to emphasize the fact that frequently aneurysms may simulate mediastinal growths.

The symptoms may be very acute in onset and the course terminate very rapidly, or we may have more slowly progressing development, and this constitutes the ordinary type of the disease.

The general symptoms are those common to malignancy—weakness, loss of weight, and secondary anemia, with a progression to complete marasmus.

The local symptoms are dependent upon the structures involved in the compression. *Dyspnea* is one of the most common symptoms. In the early stages it may be of a paroxysmal type and dependent upon exertion, but as the condition progresses it causes the most intense discomfort, and usually is continuous and independent of exertion. It may result from pressure on the trachea, bronchi, lungs, displacement of the heart and blood-vessels, pressure on the phrenic and inferior recurrent nerves. *Pain* is usually of a dull, aching type, and may be located quite remote from the neoplasm.

A number of patients that we have seen with primary endotheliomas of the lung and pleuræ with diaphragmatic involvement had, as their most prominent symptom at the beginning of their trouble, pains referred to the shoulder (Dr. Capp's work is quite illuminating on this subject). Pain may radiate down the arm as a result of pressure on the brachial plexus. With growths in the posterior mediastinum, causing compression of nerve-roots on their emergence from the vertebral column,

severe pain may be present in the back or along the lateral chest wall. Pressure on any part of the respiratory tract may produce *cough*, which may be associated with a bloody sputum, and especially characteristic is the presence of a large number of endothelial cells with fat globules, indicative of fatty metamorphosis; while, on the other hand, in tubercular trouble the red staining bacilli are present; in echinococcus hooklets and the characteristic ochre-yellow color of the sputum; in dermoid cysts hair and teeth have been observed. *Hoarseness* and *aphonia* result from compression of the inferior recurrent nerve; dyspnea and singultus from phrenic nerve compression (diaphragmatic involvement).

Physical Examination.—On inspection, protrusions and deformities of the chest wall may be in evidence, distention of the superficial veins with resulting edema, cyanosis of skin, clubbing of fingers; pupillary changes, with protrusion or retraction of the bulbus, and unilateral sweating, as a result of compression of the sympathetic nerves. Pressure on the vagus may cause cardiac irregularities, bradycardia or tachycardia, and gastrointestinal disturbances. Glands in the supraclavicular triangle and in the axilla may be enlarged. The position of the patient is often very characteristic. We may have chylous ascites and hydrothorax if the thoracic duct is involved. There may be a pulsus differens and paradoxus from pressure on the blood-vessels.

Ekgreen claims that in mediastinal growths there is a marked variation in blood-pressure of the two sides when the patient is in a recumbent position, which disappears on standing. We are not able to corroborate this statement.

It is also claimed that percussion over the spine in posterior mediastinal growths elicits an abnormal sound. Again on this point we are somewhat skeptical.

In involvement of the lung and pleuræ, in addition to the signs already given, there may be a great variation in the percussion note, at one time tympany or again a flat note, especially so if effusion is present, which is usually of the hemorrhagic type; but, on the other hand, we have frequently found that the aspirated fluid may remain serous for a considerable period of time (five or six aspirations at three-week intervals in one patient).

The sounds on auscultation are quite as variable as those found on percussion, for they fluctuate with the changing condition in the lungs and bronchi, which may be in a state of atelectasis, consolidation, bronchiectatic dilatation, complete or partial obstruction of the main bronchus, or the presence of effusion may obscure the pulmonary changes.

We shall now proceed to the examination of our patient: Mr. S. S., thirty-nine years of age, a shop-keeper, Russian, whose past history regarding disease, family history, and habits is quite negative. His complaint dates back eight months, at which time he began to experience pain in his left shoulder-blade, radiating toward the axilla. It has been of a dull constant character over the scapula. It has become considerably worse during the past few months. Atmospheric conditions, exertion, and partaking of food seem to have no influence upon this pain. A few months after the onset of the pain he noticed a gradual swelling of his left hand and arm with some disability of function. In addition to this at that time (two months ago) he developed a sweating of the left side of his face and chest. He has become gradually weaker, has considerable dyspnea, even when reclining, and not especially aggravated by exertion. He has lost about 15 pounds in weight. He has but slight cough and expectoration. There has been no urinary disturbance, and, outside of some anorexia, slight constipation and occasional eructation, no especial disturbance of the gastro-intestinal tract.

He appears to have some difficulty in respiration. There is some disappearance of subcutaneous tissue and fat. The muscles are somewhat flabby and atrophic. Resting in bed, he appears to be more comfortable lying on the right side. There is some bulging over the left mammary region. Posteriorly, at the lower angle of the scapula, there is a mass about the size of an orange which appears to be firmly attached to the underlying structures; it is hard and somewhat painful to touch. Anteriorly, in the neighborhood of the third intercostal space, 5 c.c. to the left of the sternal edge, there is another nodule of the same description, about the size of a walnut.

On examining the head, the scalp, the throat, tonsils, and tongue, we find no abnormalities.

The pupils are of normal size; no inequality; they respond to light and accommodation. There is no retraction of the bulbus.

Neck: In the left supraclavicular region we find a gland above the left clavicle the size of a large marble, freely movable and not painful.

Examination of heart and lungs: Right lung is resonant throughout and shows no departure from the normal. In the left thorax we have an area of dulness beginning at the second intercostal space, somewhat to the left of the sternum, merging into the cardiac dulness, which it completely obscures, and extends irregularly down to the sixth rib. Over this area of dulness breath sounds are very distant, percussion note flat, tactile, and vocal fremitus diminished. On the other hand, at the base we again have resonance on percussion and normal vesicular breathing (no free pleuritic effusion).

The heart sounds are clear; there are no murmurs, but on account of the area of dulness described above, which merges into the cardiac dulness, it is impossible to outline its dimensions.

The pulse is of normal frequency, compressibility, and rhythm. We find no pulsus differens nor pulsus paradoxus.

Systolic blood-pressure, right, 106; left, 98; diastolic, right, 90; left, 80.

Abdomen: No ascites. Normal liver and spleen. No masses to be felt.

Gastric analysis—normal HCl—no blood nor lactic acid or Boas-Oppler bacilli.

Lower extremities negative; knee-jerks normal.

Glandular system: No adenopathy other than that above mentioned.

There is no tracheal tugging. On deglutition and respiration, normal movement of larynx (no fixation).

The left arm and hand are swollen; muscles are flabby and thin, but do not show reaction of degeneration (no R. D.).

Urine: Trace of albumin, no albumose (chloroma).

Considerable attention should be paid to the adrenal-renal system, as we have frequently encountered so-called primary neoplasms of the lung, pleura, stomach, and liver which, at operation or necropsy, proved to be metastasized hypernephromas, with but little data to direct attention to this possible origin.

Sputum: Negative for tubercle bacilli. No so-called cancer cells. No connective-tissue or elastic fibers.

Blood: Hemoglobin 80, red blood-cells 4,000,000, white blood-cells 13,000 (no disturbance in relative counts, nor were there any large-sized lymphocytes, 10 micromillimeters or over, which most hematologists today, contrary to former teaching, regard as an abnormal finding in the circulating blood, and when present are indicative of lymphatic glandular tissue involvement).

Wassermann was negative.

Stools were negative. No blood. No evidence of disturbed pancreatic function.

Temperature showed an occasional evening rise of 100° to 101° F.

There is no tracheal tugging, no expansile pulsation over the growth, no diastolic heart shock (aneurysm symptoms).

The fluoroscopic examination reveals a normal aortic outline with irregular shadows throughout the mediastinum (probably glandular involvement).

Let us now bring our symptoms to critical analysis: We find a man with a slowly growing mass visible and palpable in the anterior and posterior aspect of his chest wall, with edema of the left arm, unilateral sweating of the left chest and arm, with evening rise of temperature, weakness, and dyspnea. There are a number of conditions which we shall have to take into consideration in developing a diagnosis in this case.

Aneurysm, compression on the sympathetic and superior vena cava, may produce the symptoms of unilateral sweating, pain, and dyspnea this man is suffering from, but we have no diastolic heart shock over the growth, no expansile pulsation, no tracheal tugging, no inferior recurrent paralysis, no pulsus differens.

Concerning the presence of echinococcus and actinomyces,

while these conditions are exceedingly rare, the possibility of their presence must be entertained in obscure cases. The absence of an enlarged spleen, bone changes, albumose, and general glandu-

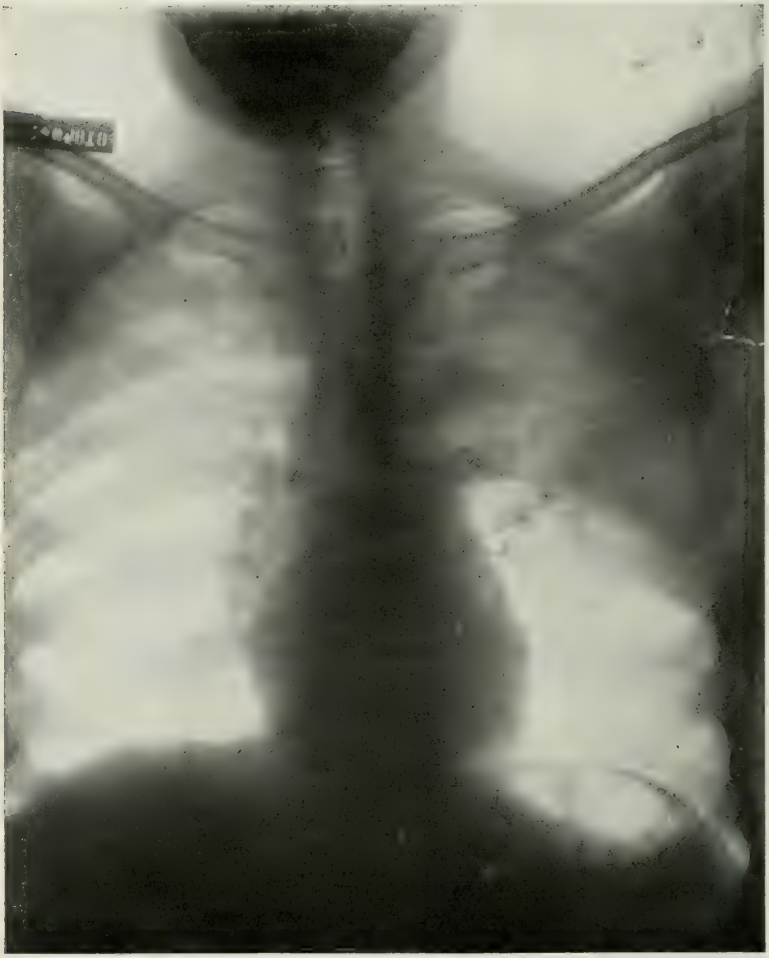


Fig. 138.—*x*-Ray showing mediastinal tumor in upper left thoracic region. Lower portion clear.

lar enlargements, together with the blood findings, will help us rule out the leukemias and Hodgkin's disease and chloroma.

On account of the evening rise in temperature, a tubercular condition must be considered in the differential diagnosis, but

the absence of the von Pirquet, negative sputum, and peculiar chest findings help us in excluding that condition.

The diagnosis then, in our opinion, is a primary neoplasm, either sarcomatous or carcinomatous, of one of the intrathoracic organs. I say primary because we can find nothing in this man's history or in his physical examination to justify us in regarding

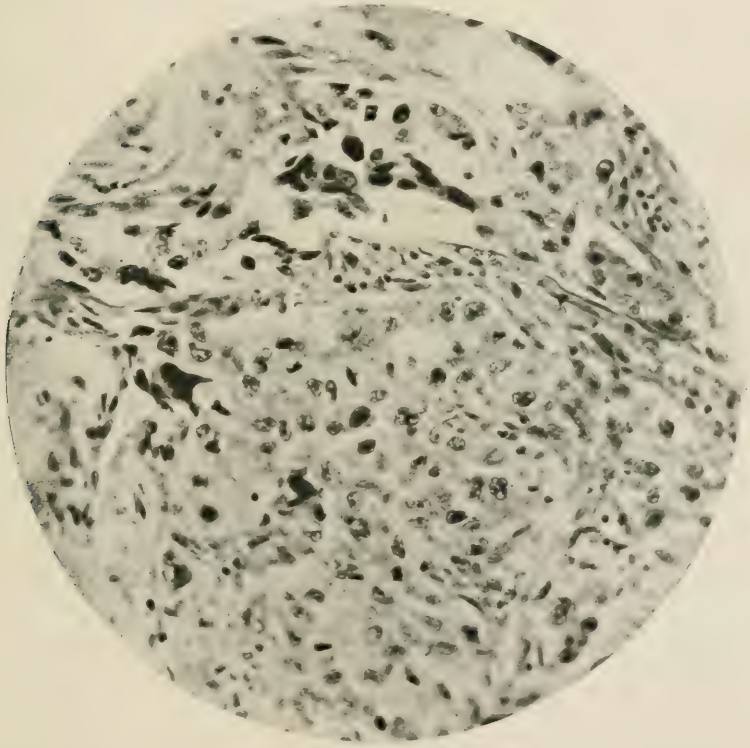


Fig. 139.—Case of intrathoracic tumor. Section from cervical lymph-node, showing metastatic adenocarcinoma. × 230.

this as a metastatic affair from the prostate, kidney, thyroid, skin, bones, stomach, or liver.

Are we in a position to distinguish between the two conditions which seem most probable in this case—sarcoma or carcinoma? We are able to answer this query in the affirmative.

If you will again examine the gland in the supraclavicular

region, before mentioned, you will find that there is an incision over it, and a partial resection of the gland was made and examined by our laboratory chief, Dr. Kirk, who reports that it is an adenocarcinoma, as you yourself may determine by examining under the microscope the specimen which is herewith placed at your disposal.

This finding rules out a primary carcinoma of the glands and makes it probable that the growth originated either in the pleuræ or the root of the lung, as no other source is in evidence.

Prognosis.—As our patient does not understand the English language we are quite safe in discussing the prognosis in his presence. In all probability he will have a lethal ending within a year.

Treatment.—Our treatment in this man's case will be directed to making him as comfortable as possible through anodynes and the intensive use of the *x*-ray, as much as 300 to 400 amperes of current being introduced with each treatment. The *x*-ray outfit employed by the author is the Freiburger apparatus, so-called because it was especially constructed for Professors Krönig and Gauss, of Freiburg.

Method.—Skin of patient is marked off into squares 5 c.c. by 5 c.c. Number of squares varies from 4 to 20, depending on size of growth.

Frequency of treatments varies from sixteen to twenty-one days, and is dependent on the skin erythema produced and the character of growth treated.

Technic.—The anticathode is placed 17 cm. from the field to be treated. A 3-mm. aluminum filter is used with a spark-gap of 22 cm. and a tube hardness of 9.5 to 10 (Bauer qualimeter), with a milliamperage of 3 to 5. At the end of 8.5 minutes we have 20 x (units) Kinboeek or 10 x Holzknecht for each field. Excellent results have been achieved in many inoperable cases. By this means we hope to mitigate this man's suffering and possibly prolong his life.

The involvement is too extensive to permit of any surgical procedure, although recently very extensive *surgery* in mediastinal growths has been performed with results which seemed impossible a decade ago.

CLINIC OF DR. ISAAC A. ABT

MICHAEL REESE HOSPITAL (SARAH MORRIS MEMORIAL HOSPITAL FOR CHILDREN)

INFANTILE LA GRIPPE

Its Protean Character. Its Mortality in Winter is Analogous to that of Gastro-intestinal Disorders in Summer. Objective Symptoms Obscure. Working Diagnosis Difficult. Most Frequent Complications, their Recognition and Treatment. The Personal Equation in Constitutional Vigor; the Exudative Diathesis; the Breast-fed Baby's Advantage Over the Bottle-fed Infant. Physician Must Study Child as Profoundly as He Would an Adult, and Consider a Baby with "Nothing But a Cold" a Serious Problem. Details of Treatment of Grippal Infection.

October 11, 1915.

DR. ABT: This infant was admitted to the hospital two months ago. The history reads as follows: A girl baby, six months old, never well since birth (normal delivery at full term); she is said to have weighed eleven pounds and three ounces at birth; fed on breast milk for three and one-half months, subsequently bottle fed (half cows' milk and half water, with one-fourth teaspoonful of sugar and a teaspoonful of lime-water to each feeding, at four-hour intervals). The baby was thought to have heart trouble, but no cardiac involvement can be found at present. The skin has been dry and the hair has been falling out since birth. The mother says the child is "drying up."

The present complaint dates back to the 7th of October, four days ago. The most striking symptom is vomiting, which occurs after each feeding. The vomiting has occurred daily since the onset. The vomitus consists of coagulated milk which is not of itself abnormal. The baby lost half a pound in the last two days.

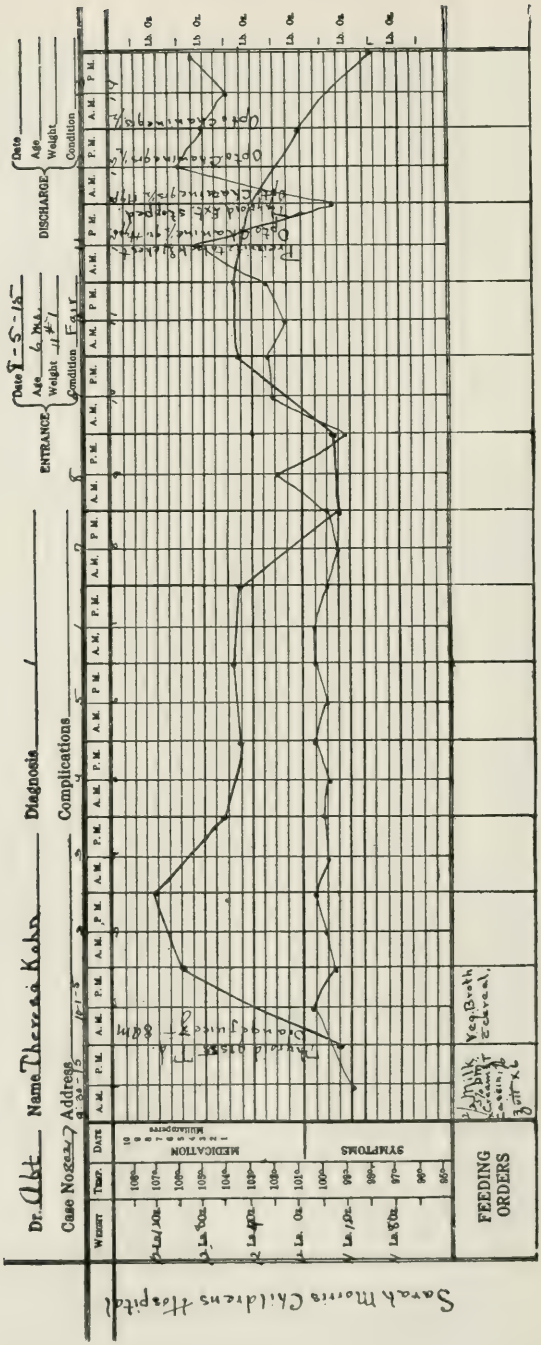

Sarah Morris Children's Hospital
Dr. Abt
Name Theresa Kahn
Diagnosis
Case No. 27
Address
Complications
ENTRANCE
DISCHARGE
FEEDING ORDERS
WEIGHT
TEMP.
DATE
MEDICATION
SYMPTOMS

Fig. 140.

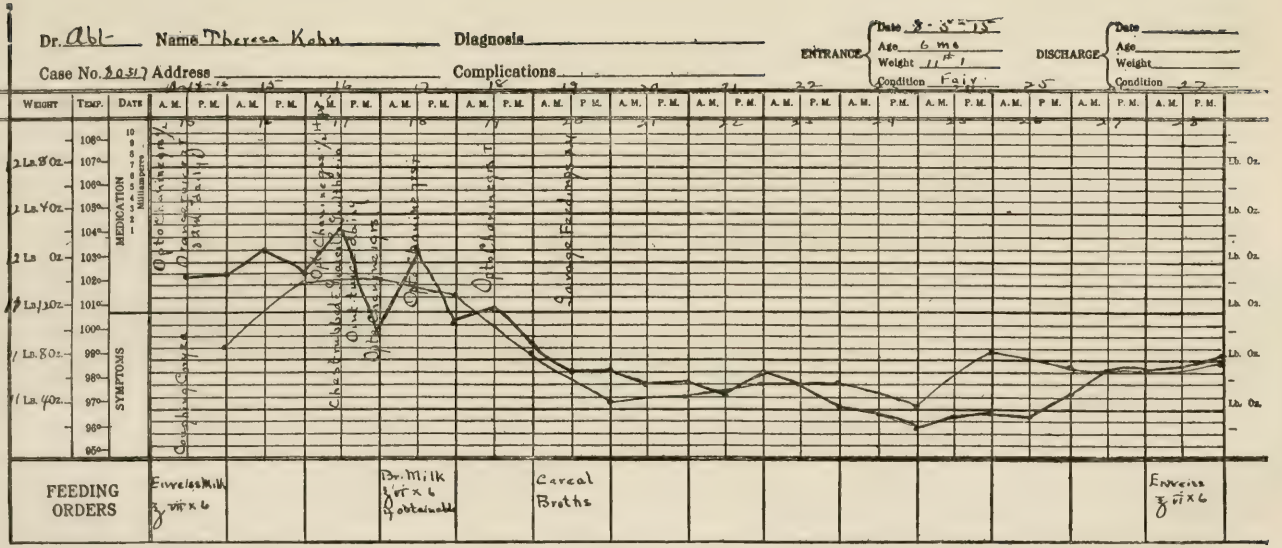


Fig. 141.

Figs. 140 and 141.—Case of cretinism complicated by la grippe. Charts showing temperature and weight curve.

The bowel movements are offensive, at times yellow and at times green. There is no diarrhea. The baby has never had a severe illness, but has always been delicate. She has no brothers or sisters; father died in an accident several months ago; the mother is well; no tuberculosis in either family.

I am not going to utilize the past history of the baby. You see, however, a plump, somewhat pale baby. She is a so-called cretin, suffering from hypothyroidism; I am not going into that phase of the case, however, at this time. The point I wish to make and to emphasize this morning is that the baby for a number of days has had an elevation of temperature. (Indicating on chart.) The baby weighs eleven pounds and one ounce today. You see at this point the temperature is 101° F., so that the baby has had some temperature off and on. Going back still further, notice that for the most part the temperature has been 98° to 100° F.; but for the past few days it has been high and the child has shown some signs of a cold—running nose, slight cough, a little restlessness. For instance (indicating on chart) we have our daily notation: On the 8th day of October she developed a cold, the nose was stuffy; on the 10th of October the breathing was still obstructed to some extent and there was slight temperature.

Now this may appear at first glance to be a small matter, possibly too trifling a case to bring into the clinic—a baby with a cold—and still it is such an important chapter that I want to take it up at some length and study it in detail.

This condition of cold or acute respiratory catarrh is commonly referred to as la grippe, the grip, or sometimes influenza, although, correctly speaking, it is not always influenza. This is the most common affection in infants during the cold season of the year. The diagnosis of the disease is not always easy. The condition presents itself in a variety of clinical ways or manifestations. It is an important disease because it is the starting-point of a great number of other diseases, and some of them may be very serious; indeed, some of them may be fatal.

La grippe influences infantile mortality and morbidity in the winter much the same as do the diarrheal diseases in the summer.

Pfaundler made the very striking observation that many babies sicken with feeding disorders and die as a result of secondary infections.

Now the winter mortality from la grippe is not so large as the summer mortality from gastro-intestinal disorders; nevertheless the mortality from respiratory diseases is considerable in the winter time. In the summer months in the large cities, and even in some of the smaller centers, the gastro-intestinal diseases have been influenced a good deal by the sociologic, philanthropic, and hygienic work of the Infant Welfare Movement, which is an international campaign of education and hygiene; a campaign that aims at the education of mothers, nurses, and physicians; a campaign that improves the milk supply and living conditions of all classes, both rich and poor. This world-wide movement has done a great deal toward diminishing infant disease and death in warm weather.

But have we not lost sight of the fact that there is a high infant mortality during the cold weather?

La grippe may occur as an epidemic or endemic disease. Finkelstein defines la grippe as a disease condition, catarrhal in character, affecting one or more divisions of the respiratory tract.

Now please remember I have told you that la grippe is not a specific infection. La grippe and influenza are not synonymous. This condition, la grippe, is a symptomatic disorder, and it must be considered in the light of an infectious disease. A variety of organisms may produce almost identically the same clinical catarrhal symptoms. What are the bacteriologic factors? Numerous micro-organisms are concerned. We know that sometimes on the mucous membrane of the upper respiratory tract a single group of micro-organisms may predominate. These may be the streptococcus, staphylococcus, pneumococcus, the Bacillus catarrhalis, or influenza bacillus; I have already said that these organisms do not produce specific infection. We sometimes find the pneumococcus predominant, with the streptococcus or influenza bacillus associated in a mixed infection, or with the diphtheria bacillus. Indeed, infection with the diphtheria bacillus is very likely to lead to error. A baby may be brought

to you with a very stuffy nose and a heavy mucous or albuminous-looking discharge, tinged with blood, the culture from which might very likely show diphtheria bacilli, and still there may be no severe clinical reactions such as are found in true diphtheria. What do we call those cases?

VISITOR: Those are diphtheria carriers.

DR. ABT: Many and many a child goes to school carrying diphtheria bacilli in the secretion of his nose or throat; he himself is apparently immune to diphtheria, but he is a carrier of this disease so far as others are concerned.

Now I have already stated that la grippe is an infectious condition; that it may be epidemic, and, indeed, not only epidemic, but pandemic. We know that sometimes these grippal conditions occur over a large area, involving almost an entire continent or two continents. You have read that they are having la grippe in London, Berlin, Dublin, Glasgow, New York, Philadelphia, and Chicago. The disease has traveled along the great lines of communication and continents have been affected by this catarrhal epidemic.

What is the method of propagating this infection? That is an important point, because it applies not only to this particular disease, but to a number of diseases. How do we believe that la grippe is carried?

VISITOR: By contact.

DR. ABT: Yes, we are frequently the carriers. Thirty or forty years ago, when yellow fever and cholera prevailed, the ports were quarantined, cargoes were destroyed for fear that the fomites—coal, iron, grains, and other imported products—would carry the disease; but the sailors, sick or well, were the carriers. La grippe and a host of other diseases are carried by those who are severely or mildly infected. In passing, it should be mentioned that disease-carriers may give no clinical evidence of infection and nevertheless be capable of communicating the disease to others. It is true that scarlet fever may be a milk-borne disease, but in a large number of cases it is carried by other persons; it is frequently conveyed by some human agency—some individual who may have a sore throat or a discharging ear or nose,

and is himself immune to scarlet fever reaction, but who, nevertheless, carries on his person the germ that will produce scarlet fever in another. We must remember that all infectious diseases are not spread by human agencies, but for the most part they are a milk-borne or water-borne disease. Diphtheria is at times carried by the milk and food supply, still we know that if one or two cases of diphtheria are admitted into our wards an epidemic will spread like wildfire; the disease is carried or spread not through the air, but by contact infection.

We have digressed from our subject. Let us return to our text—la grippe; how is la grippe communicated to the baby? Very often the mother says that the baby has a very bad cold. If you ask, "Has anyone else a cold?" the reply almost invariably is, "The nurse had a bad cold," or "a number of other children had bad colds." The infection is spread through the entire house and sooner or later the baby falls ill. How about the hospital? If a baby in our ward falls ill with la grippe, and we are not extremely cautious and prudent, it will not be long before nearly every baby in that ward is similarly ill. If it were only a little cold we might shrug our shoulders and say no more about it, but we know there is a definite and sometimes high mortality associated with la grippe in our wards. What do we do? If one falls ill we take the baby out, or if we discover a nurse that has a cold we send her away from the baby, or if an intern has a bad cold we excuse him temporarily, because we know the disease is carried in this way and we know that the toll is heavy.

During the time that la grippe is raging we isolate the sick baby as much as possible in the hospital. In the home the same prophylaxis should be enforced. It is too much to hope that these methods should be universally adopted at once. The public requires education in this important matter of disease prevention.

With reference to the clinical manifestations of la grippe, it might be well to consider the constitution of the baby. Infants vary, as do adults, in their susceptibility to this infection. Babies are influenced by environment, hygiene, and constitution.

Babies inherit certain constitutional characteristics; they inherit certain tendencies; they inherit a certain strength; some infants are strong and robust, and you can feed them on tacks and strings and rags, figuratively speaking, and they seem to keep well and grow in spite of it; some babies are fed on the finest morsels you can buy in the most elegant shops, they are nursed by loving lands, but they fade and wither and succumb to infection. What causes the difference?

There is a good deal in the constitution of the individual baby. It is the fiber that these babies are made of, it is the woof and texture in them; it is the strength that is in the stock and breed that determines very frequently the health and resistance not only of the baby, but of the mature human being throughout life. Of course, later on the constitution is vitiated by all kinds of wear and tear, by overwork, by stress, and by exercise, by dissipation, by careless living, by disease and neglect.

In the infant the severity of la grippe and every other infection varies with the age and the constitution of the baby. Let me spend another moment on the relation of infection to the age of the baby. If a baby under a year old falls ill with scarlet fever the course of the disease is severe and the mortality high. And so it is with other infections—diphtheria, measles, whooping-cough, etc. Erysipelas is one of the best examples. If a newborn baby falls ill with erysipelas the course is rapid and usually fatal. On the other hand, children over one year old nearly always recover. I will ask you how you explain this difference in resistance between young babies and older children?

VISITOR: Acquired immunity.

DR. ABT: You mean this, that a newborn baby has developed very few antibodies; it consequently has feeble resistance against infection. As time goes on and the baby grows older he acquires resistance as a result of the development of greater numbers of antibodies. In other words, we may say that in young infants the antibodies are poorly developed. The fact is that clinically we can, from our experience, predict the prognosis depending upon the age of the patient.

The onset frequently resembles an acute gastro-intestinal attack or it may resemble an attack of meningitis, for in infancy very often the general constitutional symptoms overshadow the local symptoms. The baby is very much prostrated at first, he is somnolent, refuses his food, is restless, sleeps in short snatches, wakes up as if in pain, and falls asleep again. Most of these babies have inflammation of the respiratory mucosa. They suffer from pharyngitis, laryngitis, tracheitis, nasopharyngitis, and bronchitis to start with; I am coming back to this group later. Some of these babies have high fever without any catarrhal manifestations, which gives rise to great difficulty in diagnosis. I can remember very well, from my own experience, babies four or five or six months old with continuous high fever (105°, 106° F.), slight findings, possibly stuffiness in the nose, a good deal of restlessness, somnolence, anorexia, some vomiting, but no localized symptoms, nothing in the ears, nothing in the urine, just a raging, high fever. Such a case might run ten days to three weeks and then subside. This form of la grippe is not at all uncommon. It appears during the time of the year when the disease is rampant, and the diagnosis must be made by a process of careful exclusion. The first reference that was made to this typhoidal form of grippe came to my notice in Ashby and Wright's book on Diseases of Children.

In the older children la grippe resembles the disease as it occurs in adults, and we shall not concern ourselves with any of the details which have special reference to the adult type of the disease. But in infancy the story is usually related as follows: A previously healthy baby began suddenly to show signs of prostration or malaise, began to hang his head, he wanted to be kept quiet, wanted to be held in the mother's or nurse's arms, or he preferred to lie in bed; he vomited shortly after taking food, and the vomiting was a prominent and troublesome symptom. The initial vomiting in la grippe, as in so many infectious processes, is an expression of toxemia, and not, as is so frequently supposed, of a gastro-intestinal disorder.

Vomiting occurs as an initial symptom in meningitis, pneumonia, and scarlet fever of infants and children as well as in

cerebral diseases and gastro-intestinal disorders. And so this baby with la grippe vomits. First he vomits food he takes and then he will vomit almost incessantly; he will vomit the water he swallows; he is showing toxic symptoms. Besides that, he is restless, sleep is superficial, he loses his normal color, he becomes pale or ashen gray, his skin is hot, his temperature is high, and in a few days, if the case is mild, the temperature falls, and the baby begins to show a return to normal health. Or the patient presents another type: He runs a febrile course for several days with more or less complete anorexia. A breast-fed baby refuses food or he takes a few swallows and then stops. Why? Very often the nose is stuffed up, and when his mouth is applied very closely to the nipple he can't breathe, and then if he breathes he can't eat. Anorexia is explained by mechanical interference with breathing in some cases. The general condition of the baby is greatly disturbed. He loses in weight because he is not eating any food; he remains ill for a week or more, shows the result of infection possibly for a considerable time, he is anemic, he is prostrated, his appetite is diminished.

The inflammation of the nasal mucosa in infants may manifest itself by mouth-breathing and by the failure of the baby to apply himself to sucking at the breast or bottle. The nose does not show a purulent discharge. The nasopharyngeal involvement is sometimes difficult to diagnose. Sometimes it can be discovered by the nasal voice. Mark these points now: There may be "fetor ex ore" (a disagreeable odor from the mouth). The inspection of the pharynx does not always corroborate these symptoms. Sometimes one looks into the baby's mouth and throat and cannot discover that there is nasopharyngeal involvement. At other times, however, the examination of the pharynx shows redness, swelling, an accumulation of mucopus on the posterior or lateral wall of the pharynx, and, in addition, many of these babies have an irritating cough.

It is sometimes difficult to look into the baby's throat. You cannot do it by yourself. In order to get a glimpse at the

baby's throat it is necessary to have him in the proper light, with a willing and intelligent assistant.

To sum up: The examination sometimes shows nasal voice, fetor ex ore, difficulty in swallowing, and definite physical findings in the thorax.

When the symptoms are confined to the nasopharynx there are very few objective signs in the respiratory organs. The wrong diagnosis is easily made. Usually the baby is thought to be suffering from gastro-intestinal disturbance. That belief is strengthened by the fact that the baby is vomiting, has anorexia, and refuses food; sometimes the baby has diarrhea or constipation, and it is natural to suppose, too, that when the baby has a bad odor from the mouth there is some putrefaction in the intestinal tract. The fetor ex ore is almost pathognomonic of some trouble in the nasopharynx or pharynx.

Gastro-intestinal disorders are also characterized by loss of appetite, but there are usually more manifest gastro-intestinal symptoms. It should be said that when the disease is purely gastro-intestinal, if the food is withdrawn for twenty-four hours and then proper food restored (say, for example, after a diet of tea and toast or tea sweetened with saccharin for twenty-four hours) the condition should improve. If, however, the gastro-intestinal symptoms are due to some other infection outside of the gastro-intestinal tract the simple dietary plan does not avail.

La grippe is a disease which gives rise to intestinal symptoms without any intestinal lesions. Such a condition of affairs is referred to as parenteral infection. The rest of the grippal infection may be in the respiratory tract or in the kidney or pelvis of the kidney, remote from the digestive tube. The alimentary symptoms are an expression of the general toxemia, consequently the gastro-intestinal symptoms are parenteral.

The temperature: We notice that the fever may be of various types; it may be continuous; we may have a pyemic form of fever, which may last four or five days, with complete remission for a number of days, and then a relapse occurs with high temperature and possibly complications. We will come to that in a few moments.

Not infrequently we find enlarged lymph-nodes in the neck following down the sternocleidomastoid muscles.

Often coughing occurs. This may be due to nasopharyngitis or enlarged tonsils, or pharyngitis or laryngitis, or to tracheitis. Frequently auscultation of the chest is negative. You examine the chest most carefully, percuss and auscultate, and you can scarcely hear a râle or rough respiratory murmur. You may distinguish a hoarse, laryngeal cough due to acute catarrhal laryngitis, which sometimes resembles whooping-cough. Persistent cough reduces children very much, it causes restlessness, leads to vomiting, and interferes with nourishment and sleep.

I have already told you that the general symptoms of la grippe are restlessness, fretfulness, disturbed sleep, and fever which may run a variable course. First, the fever may last one or three days and terminate in a spontaneous cure; second, in another group the infection will run ten or twelve days and gradually disappear, but the fever may last longer (three, four, or even eight weeks), and it is thought that possibly the baby is suffering from tuberculosis or some obscure infection—a slight intermission with evening exacerbation to 102° or 103° F. may continue for many weeks.

In some cases no local findings can be detected. Sometimes a few glands may be palpated or enlarged, or suppurating glands may be deep in the tissue.

In the pyemic type of the disease the temperature may vary from 101° to 106° F.; these are the daily variations. Or there may be the postgrippal type of pyemic fever in which the temperature may have been normal for several days, to reappear and run a septic course for days or weeks. Or the type may resemble a typhoid, with a continuous temperature for a considerable time.

Then there is another point: Some babies may have no fever—a perplexing feature sometimes. The baby that is feeble, has low resistance, a poor constitution, a premature baby, or one that is in very poor nutrition may run a normal or subnormal temperature and still suffer from severe infection. Or

there may be swollen lymph-glands on the posterior pharyngeal wall, complicating this grip. And these may terminate in abscess, commonly called retropharyngeal or postpharyngeal abscess. Please tell me how the diagnosis of retropharyngeal abscess is made?

VISITOR: By the attitude of the baby's head.

DR. ABT: What is that attitude?

VISITOR: It is usually held back and stiffly to one side.

DR. ABT: What else?

VISITOR: He has a peculiar cry.

DR. ABT: What is the character of the cry?

VISITOR: It indicates fulness in the throat; it is a peculiar muffled cry. Breathing is nearly always snoring and very characteristic.

DR. ABT: What is the best way to diagnose retropharyngeal abscess?

VISITOR: Just feel it.

DR. ABT: It is not the man who proceeds as if he were getting ready for a combat, but the man who introduces his finger gently into the pharynx, as though he were touching his own eyeball, that detects the retropharyngeal abscess. The diagnosis is not made by forcible palpation, but the gentle touch will reveal all the elevations and depressions in the throat of the baby.

I would like to finish the subject at the next clinic, for it illustrates very nicely a common infectious disease in infancy. It brings out a good many of the principles of infantile symptomatology, pathology, and treatment. We are reminded of what professor Osler was quoted as saying, "One disease well studied is worth a whole text-book of diseases only superficially studied." It is a great deal better to study typhoid fever and know typhoid fever thoroughly than to know a whole group of diseases imperfectly.

October 18, 1915.

DR. ABT: This is the baby I showed you a week ago. To turn briefly to the last few days' history sheet we note that on the 10th the baby had 101.2° and 101.4° F. temperature, 128 pulse, 40 respiration. On the 12th the baby's temperature was 103° F. at one

time, respiration 40, and pulse 148. On the 15th the temperature was 103°, 101°, 102° F. Pulse at one time 104; at another time 128, and respirations 38. On the 16th we find the respiration 36 and the pulse 124. On the 17th the respiration 60 and the pulse 130.

You remember when you saw this child last week the condition was confined almost entirely to a nasopharyngeal catarrh, that is, running nose and reddened throat. As you see the baby today, you notice that she has lost somewhat in weight, shows marked pallor, and if you observe the respiration you will note that she breathes stuffily—the nose is stopped up. Watch the nose a little bit and you will see that the alæ nasi do not dilate; there is no rapid, labored breathing. If you observe carefully you will see a little blueness about the upper lip, indicating a slight cyanosis. She cries lustily. Professor Henoch, the pioneer pediatrician, said that when a baby cries lustily it is a pretty sure sign that there is no severe pneumonic involvement. She does not seem drowsy, and as she breathes you notice that the accessory muscles of respiration are not involved; she breathes quietly at this moment. But if you note the ratio here, where it was possible to count the respirations, you will see this:

Respiration.	Pulse.		
40	128	$\frac{1}{3}$	
36	98	$\frac{1}{2}$	$\frac{1}{3}$
40	148	$\frac{1}{3}$	$\frac{1}{4}$
38	130	$\frac{1}{2}$	$\frac{3}{4}$
36	124	$\frac{1}{3}$	$\frac{1}{8}$
60	130	$\frac{1}{2}$	$\frac{1}{6}$

Wherever there is a marked change from the $\frac{1}{3}$ type—that is, marked increase—we suspect that there is something wrong in the respiratory tract.

Look at the baby again. She has lost somewhat in weight, is a little cyanotic about the lips, breathes rather rapidly, though not in a labored way, the fontanel is not particularly sunken in, the eyes look bright, the color of the skin has lost its pink hue and she is a little grayish. The child appears to hold its head rigidly, but there is no real rigidity. She moves her hands.

You will notice I am auscultating first. Usually when one begins the examination by percussing the child thinks it is being punished. It is usually better to leave percussion for the last. There is nothing to be detected here on percussion or auscultation. This matter of percussion is frequently attended with great difficulty unless the baby is held in proper position, for if the muscles are contracted dulness may be elicited. Now notice how the nurse holds this baby; it is a very good way to hold it. The baby is sitting on the forearm of the nurse with the head on her shoulder. The baby is held in as relaxed a position as possible, and the attempt should be made to hold the little patient in an erect position with the arms hanging loosely to the side and the spinal column in a straight line. It should become second nature to notice that the baby is straight before percussing. Now, auscultating again, the most you can say is that the breathing is a little rough, but one does not really hear any fine râles. We must not forget, however, that the respiration was rapid, the pulse frequent, and the pulse-respiration ratio was 1 to $2\frac{1}{2}$ or 3. In the respiratory diseases of children the subjective symptoms are sometimes of greater importance in diagnosis than the undependable objective examination. The abdomen is moderately distended, but not painful. Otherwise the physical examination is negative.

So we have here a baby that has grown considerably worse since the previous clinic (October 11th). Though the physical findings are negative, we presume from the symptoms there is some pulmonary involvement. At the last hour we briefly referred to glandular fever. This so-called glandular fever is a condition that was first described by Pfeiffer, and it is sometimes known as Pfeiffer's disease.

Glandular fever occurs in the winter time or in the early spring, as a rule, and makes itself manifest by occurring usually after a slight nasopharyngeal infection, very often in epidemic form; very shortly one finds that the glands at the angle of the jaw, or lying either anterior or posterior to the mastoid muscles, become swollen, and soon the swelling assumes great proportions. The swelling is frequently bilateral. The children suffering from

this condition usually have very high fever. Indeed, the fever may rise to 105° or 106° F., and sometimes, though rarely, there is a middle-ear complication. This temperature may continue high for several days or a week. Occasionally respiratory complications occur, and not infrequently an acute hemorrhagic nephritis complicates the disorder. In true cases of glandular fever suppuration rarely occurs. In the earlier days a gland was occasionally incised with the idea of draining it, without finding pus. These cases of glandular fever we believe are true grippal infections, and this condition should not be described as an entity, but as a complication or glandular manifestation of la grippe.

Otitis media is the most frequent complication of la grippe. It is surprising how many babies fall ill during a grippe attack with middle-ear infection. Naturally, we assume that when the nasopharynx is involved the infection reaches the Eustachian tube and passes into the tympanic cavity and there produces inflammatory reaction. Middle-ear catarrh seems to be part and parcel of the general infection. If you have a severe nasopharyngitis extending over several days, why should not the inflammatory secretion find its way into the middle ear and produce a reaction? As a matter of fact, it does that very thing in a large number of cases.

In older children the diagnosis is comparatively easy. The older child complains of severe agonizing pain. The younger baby, the infant, cannot definitely complain of pain. He evinces pain by throwing his head back, by restlessness, sleeplessness, loud shrill crying, but he rarely puts his hand to his ear. Little infants do not localize pain very accurately; indeed, somewhat older children have difficulty in localizing pain. In older children nearly every practitioner can diagnose an otitis media by the swelling and redness, and fluid in the middle ear and pain. In younger children and infants the examination is sometimes attended with great difficulty, especially in those cases where the auditory canal is tortuous and it is difficult to insert the speculum, so that we must sometimes diagnose the middle-ear catarrh of little infants from the symptomatology.

Supposing that you do find a moderately reddened membrane, slightly bulging, and the child has moderate pain, what is the indication for immediate treatment? There is some question among physicians of large experience as to what should be done. There are those who would puncture every tympanic membrane that seems at all red, and there are those who believe in a more conservative course. Now you know that a great number of these catarrhal conditions, or acute inflammations of the middle ear in children, pass practically unnoticed without any radical treatment. We know, on the other hand, that a great many of them are punctured without establishing any drainage. I feel like joining the conservative element, who believe that puncture is not indicated unless there is a distinct bulging and long-continued pain with continuous temperature. If the drum membrane is merely reddened a subsidence may be awaited without puncture. Remember this: That when the pain is intense, when the cavity is filled, when the pus is forming in quantity and the bulging indicates that the fluid is accumulating rapidly, then the membrane should be punctured; but ordinarily, when slight redness of the nasopharynx and of the drum membrane is noticed, one should wait and not perform an immediate paracentesis.

Otitis media, as a rule, does not indicate a bad prognosis in young infants. Considering the large number of cases of otitis occurring in young children, mastoiditis is relatively rare. Mastoid infections, meningitis, and cerebral abscess do sometimes occur, but these complications fortunately are rare.

Another variety of cerebral infection occurs presenting itself as a non-suppurative encephalitis. This condition has been described pathologically as a "spotted yellow" or "spotted red" encephalitis. It frequently localizes itself in the cortical area of the brain, particularly in the motor areas, and produces hemiplegia or other paralyses. If localization takes place at the base and in the region of the medulla, sudden death is the result. If the pons is involved (a favorite site for this infection) what variety of nerve lesion occurs?

VISITOR: Crossed paralysis.

DR. ABT: Yes. These cases of non-suppurative encephalitis are not infrequent in children of any age.

In the same way meningitis may occur as a result of la grippe infection and it may be a pneumococcus meningitis. The pneumococcus may gain access through the nose or nasopharynx, and before one knows it the baby is severely stricken. The cerebrospinal fluid is cloudy or straw colored, swarming with pneumococci. These cases are nearly always fatal. Carefully studied cases of meningitis due to influenza bacillus have been described from time to time.

We have already referred to bronchitis. It occurs as a complication of these la grippe cases; sometimes it is diagnosed by the dry and moist râles, sometimes by roughened breathing. Capillary bronchitis may be recognized by the presence of the characteristic crepitant râles in young infants, though at times it is difficult to diagnose on account of the diminished breathing due to general weakness. Auscultation sometimes fails to give satisfactory evidence. If you go to the autopsies diligently, and will study sections of the lungs of little children, you will find the pathologist surprises the clinician very often. He will find small or large foci or bronchopneumonia that the clinician had not detected. This is due to the difficulty in making a clinical examination. But the pallor, the gray color, the rapid breathing, the change in the pulse—respiration ratio already referred to—aid in the diagnosis. The nurse should record pulse and respirations during sleeping hours. In practice the nurses frequently fail to do this. There is a great satisfaction in giving the child every attention that is possible without limited knowledge, and for that reason it is important for the nurse to keep a careful record.

I would like to say a word before going further: As physicians our problem is one of education; we have to help the babies all along the line if we are to be real useful agents in saving infantile life. The physician himself should give careful attention to the infant. The baby that is sick requires as careful thought as the adult who is sick; he deserves the same study and consideration, and, I say this emphatically, very often he does not

get it. If you will sit by the bedside of the little patient, if you will make him your problem, if you will watch him, study him, and unravel or solve the problem, give him the benefit of all your clinical intuition, study his blood and secretions in the laboratory, but study the baby at the bedside (do not depend on the laboratory man exclusively to make your diagnosis), think about your case, then the patient will receive the benefit of the very best that you have. The fault is not that men don't know; it is that men don't study their cases and don't spend their time on them. The thing I started to say referred more particularly to the nurses. A great many good, noble women in the world are in the nursing profession. It is a surprising thing that there are so few who are really capable and efficient in the care of infants. They do not appreciate the importance of many things. We physicians must take our share of the blame; we have not pointed out to the nurses the value of taking the respirations and pulse carefully. We have not shown the nurse how to take the temperature, watch the respirations, note the changing color, nor taught her the little bedside problems of which she should have knowledge and tell us about. We have not insisted upon real scientific records. We come in the morning and say, "How are the bowel movements?" "Very good." We are satisfied. We don't ask them whether the bowel movements contained blood or mucus, or brimstone or fire, or what not; we simply take her word—"They are very good." I thought I would mention this in passing, because it is a matter of daily observation and constantly before us.

Pneumonia is not an infrequent complication. The pneumonia may be of the bronchopneumonic type, of the capillary bronchitic type, or of the lobar pneumonic type. It is not my purpose to discuss this disease group at this time at any length. Pneumonia protracts the disease, particularly the febrile course, and, indeed, a pneumonia may be complicated by an empyema; an *x*-ray examination sometimes clears up a diagnosis of pneumonia or empyema when physical findings are indefinite.

Endocarditis with valvular lesions may occur, though they are not frequent. The most common cardiac affection in grip

is myocarditis. And let me say a word about myocarditis in relation to acute infections: The myocardium is very susceptible to the toxic products of most of the organisms that produce acute infectious and contagious diseases, *i. e.*, measles, scarlet fever, typhoid fever, diphtheria, and influenza; almost any of the acute infectious or contagious diseases that you can think of may produce effects on the myocardium in the form of an acute inflammatory reaction, producing decided symptoms—dilatation with tachycardia or bradycardia, pallor, cardiac weakness, cyanosis, and moderate dyspnea. Very marked anorexia is an important symptom. The condition may progress to a marked cardiac insufficiency. The weakened heart muscle may persist with signs of arhythmia and cardiac weakness long after the infective process has subsided. Infrequently, at the end of an acute infectious disease, the heart may be slow and irregular, or it may be simply slow. We know or feel that the myocardium has suffered somewhat, either by inflammation or degeneration, and we treat the patient with due consideration and pay special attention to the heart. Remember that a disturbed myocardium is a very important factor in acute infectious and contagious diseases.

Peritonitis is an occasional occurrence. Nearly every winter several cases come under observation. We had a baby brought in last winter who started to be ill with symptoms of a grippal infection. On examination, there was a little dulness in the right lower thorax with a few râles, a very distended abdomen, and great abdominal pain. His face was gray, his eyes sunken, his expression that of intense pain; he had pain when he moved his extremities and when the bedclothes were changed. The child was continually crying and whining. Eventually he developed fecal vomiting, flatness on percussion of the lower abdomen and flank, though the distention increased. At first there was some diarrhea; later on there was complete obstruction because of bowel atony. In this case there was a limited pulmonary involvement at the right base which showed no tendency to progress. It is true that not infrequently a frank pneumonia will produce abdominal symptoms which may

simulate a true peritonitis, and the course of the disease makes it evident that the abdominal symptoms were due to reflex irritation from an inflamed lung or pleura. On the other hand, a grippal peritonitis may occur without any preceding pulmonary pleural involvement. These are usually pneumococcus infections. The grip infections may extend through the lymphatic channels or as the result of a general blood infection. In this way it is easy to explain the remote infections which occasionally occur. Osteomyelitis and joint involvement are among the less common, nevertheless well authenticated, complications.

The kidneys not infrequently become involved. It is not uncommon to find albumin and casts, as in almost any acute infectious process. At times cases of hemorrhagic nephritis occur, especially where there is extensive lymph-node involvement. As a rule, the acute hemorrhagic nephritis in this disease offers a favorable prognosis, though uremia and convulsions may occur. I sometimes question how many cases of hemorrhagic involvement are due to our therapeutic endeavors. Possibly there would be less of it if urotropin were given in smaller doses or omitted entirely. There is a curious thing about mental action: the human mind has to go through a certain cycle. Because urotropin is a urinary antiseptic, and because it is eliminated by various secretions, it has been supposed that it can destroy micro-organisms in the remotest nooks and corners. Consequently urotropin is used for coryza, bronchitis, meningitis, and poliomyelitis, as well as a host of other infectious processes. Urotropin is not devoid of danger when injected into the human organism. Drugs that are taken into the economy must be eliminated in some form or other, and the formaldehyd which results from the splitting up of urotropin in the body is no plaything when it comes in contact with an already irritated, congested, or partially inflamed kidney. If the drug be continued sufficiently long, hematoma occurs. This statement rests on experimental as well as clinical data.

Babies sometimes during the course of la grippe develop a pyelitis. One is amazed at the great number of complications which occur in grip infection. You will recall that pyelitis

usually occurs as a result of a colon bacillus infection of the urinary tract; that it occurs more commonly in little girls than in little boys. It is usually associated with high fever, sometimes abdominal pain and painful micturition. These babies show an intense pallor and may become much reduced in health. It is not easy to explain the relation of grip infection to pyelitis, unless one assumes that the pyelitis was chronic or latent and that the infection produces a recurrence by some unknown irritation of the urinary tract. It would not be correct to infer that every specimen which contains a few leukocytes is evidence of a pyelitis. If the pus is present in considerable quantity, the existence of pyelitis may be assumed. Notwithstanding the fact that pus must be present before a positive diagnosis of pyelitis can be made, nevertheless several specimens of urine may be examined in which the urine remains free from pus, and finally a specimen obtained which contains leukocytes in abundance. I am sure this experience will be verified by every clinician who is accustomed to seeing these cases.

October 23, 1915.

DR. ABT: Again we see the baby I showed you on two previous occasions (October 11th and 18th). She is much brighter and is taking food, but shows the effects of severe illness. Just glancing at the infant you can see a marked improvement in the past five days.

At our last meeting we finished speaking of kidney involvement and urinary infections. When grip attacks spasmophilic children it is very likely to produce severe nervous manifestations. What is spasmophilia?

VISITOR: A tendency to spasm.

DR. ABT: Spasmophilia is a measurable increase in electric muscle-nerve excitability, and by "measurable" I mean that the grade or extent of spasmophilia may be recorded by the galvanometer attached to a galvanic current; it is a measurable increase of nervous irritability. Children suffering from spasmophilia are predisposed to convulsions, both tonic and clonic. Without going into great detail, by spasmophilia we mean a

latent condition of nervousness which may become a manifest condition under the influence of certain exciting factors and may express itself as a tetany, which is really a manifest spasmophilia, or as convulsions, or as laryngismus stridulus. The principal test for the demonstration of spasmophilia consists in the fact that under normal conditions the cathodal opening contraction responds to 5 milliamperes or over as measured by the galvanometer; whereas in spasmophilia the same contraction occurs with a weaker current—4 milliamperes, 3, 1, or even less. A spasmophilic baby that falls ill with la grippe is very likely to be more markedly nervous or irritable, is more likely to have eclamptic attacks, than a normal baby. Indeed, a baby with grippal infection may have a latent spasmophilia transformed into a manifest spasmophilia or tetany.

It is well to state that the underlying constitutional conditions of the baby assert themselves when grippal infections occur. For example, we say that babies have an exudative diathesis. To the modern student of medicine it savors of the days of the ancient physician who spoke in a rather vague, speculative, or mystical way about diseased conditions; possibly we are going back to that day; possibly we are again beginning to think along the lines that the man of the Middle Ages talked and thought. But, at any rate, this condition of exudative diathesis represents a distinct clinical picture, a symptom complex which we cannot fail to recognize, which repeats itself time and time again in our daily visits and observations, and, though we cannot offer an adequate explanation, still we accept the symptom complex much as our forefathers accepted the unknown pathologic conditions. Tuberculosis, syphilis, typhoid fever were all recognized long before we understood the true etiologic factor or the more intimate pathologic nature of them. The great Louis, of Paris, in 1892 described typhoid fever as accurately almost as it is described in any text-book today. Bretoneau, the teacher of Trousseau, described diphtheria without knowing its etiology or pathology, and if you will read his classic descriptions you will be amazed at the very intimate and sound knowledge that this great physician had of diphtheria. So it is with the exudative

diathesis. What is exudative diathesis? It is a condition in which there is an exudation on the skin that presents itself as an eczema and an exudate on the mucous surface in the form of enlargement of the tonsils and adenoids, a tendency to bronchitis and asthma and also to gastro-intestinal disturbances; besides these, there is a peculiar growth of the hair on the scalp and a seborrheic condition of the scalp. One sees a large number of these cases, all acting alike, presenting the same clinical picture. When these babies are attacked by la grippe they are more intensely ill than infants not so affected. The eczema becomes more severe and lymph-node enlargement is marked, the bronchitis is more intense, the tendency toward bronchopneumonia is more pronounced, and, indeed, the fatality among babies suffering from this constitutional vice is very high.

I have spoken to you about the vomiting. La grippe is frequently ushered in by vomiting. Very often the mother reports that the baby is bilious or has spoiled its stomach; the vomiting is intense and persistent. Then, too, these babies suffer from anorexia, which is persistent and extreme. Sometimes they suffer from constipation, and they may suffer from severe gastro-intestinal disturbances characterized by diarrhea, tympany, and thin, watery stools. Some of these intestinal conditions are due to parenteral infections. By "parenteral infection" we understand the occurrence of intestinal symptoms dependent upon a disease process outside of the alimentary tract. These alimentary disturbances may occur with a pharyngitis, tonsillitis, an otitis, or a more or less severe pulmonary affection. We assume in such cases that the intestinal tract is free from demonstrable pathologic changes, and the intestinal disturbance is due to intestinal toxemia. It goes without saying that a true infection of the gastro-intestinal tract may occur even to the point of bloody stools. La grippe may be mild or severe. I have already told you that some cases last a few days; some will last a week or two; not a few of them are associated with severe complications; some will run a protracted course and simulate tuberculosis; some run a course of weeks or months with glandular

involvement, or with pneumonic foci in the lungs or with local pleuritic inflammation.

There is a difference in the nature of the child that is attacked. I have already pointed out that feeble children, prematurely born children, children under three months of age are very likely to be more seriously affected. The complications are likely to be more marked, the course of the disease is likely to be more severe and more protracted, and, all in all, the disease is likely to be more fatal in young infants and in feeble infants than in older children. Such babies may fall ill with la grippe, the temperature may be very high, the child may be severely stricken. Still, as a rule, the breast-fed baby shows greater resistance, is less severely felled by the disease, makes a more speedy recovery and shows a lower mortality, and consequently fewer complications than the babies who are bottle fed. You may deduce from this the important corollary: *That a breast-fed baby under all circumstances, but especially during the first six months of life, has greater resistance against disease and infection and shows a lower mortality when infected than a hand-fed baby.*

Rachitic children are likely to be severely affected. The baby with the rickets—with a thorax that is soft or deformed and retracted on inspiration—is more likely to suffer pulmonary complications than children who are not rachitic. Consequently, we may say that rickets in young babies falling ill with la grippe influences the course of the disease, invites complications, and renders the mortality higher than in non-rachitic children.

An acute grippal attack will frequently act as the direct exciting cause of an attack of asthma in children who are congenitally predisposed to this disease, or in those suffering from an exudative diathesis with an asthmatic tendency. An attack of asthma in an infant or a young child presents a distressing picture. The dyspnea is very marked, and the struggling child presents an anxious appearance, and one who is not accustomed to seeing children suffering from this disease is apt to think that death is impending. On auscultation one hears numerous râles with diminished breath sounds.

So far as the diagnosis of la grippe is concerned, little need be said, yet there are a few points in differential diagnosis which we may profitably discuss.

The diagnosis of la grippe itself depends upon the clinical signs which I have already referred to—discharging nose, nasopharyngitis and tonsillitis with glandular enlargement, conjunctivitis, tracheobronchitis, vomiting, and prostration. Now in examining the nose it should be pushed up a little bit and the nares inspected. A bloody discharge from the nose often or nearly always means what?

VISITOR: Diphtheria or syphilis.

DR. ABT: That is quite right.

Sometimes you can see an exudate on the mucous membrane of the nose; a foreign body may have been introduced. It is important always to make a cultural examination of the secretion of the nose and throat; perhaps the patient is a diphtheria carrier; possibly there is a true diphtheria or an influenza-bacillus infection. The nasopharynx is extremely difficult to examine, though it is frequently the site of a severe inflammation.

La grippe may be mistaken for measles, especially during a measles epidemic. At the onset, when the baby begins to sneeze and cough, to have a little conjunctivitis and some temperature, it is very difficult to tell whether the baby is going to fall ill with la grippe or measles. What helps us very much to make the differential diagnosis?

VISITOR: In measles there are spots on the internal aspect of the cheeks.

DR. ABT: You refer to the Koplik spots. On the internal aspect of the cheeks one sees a number of bluish-white spots surrounded by an areola of redness. The exanthem in measles very soon appears on the roof of the mouth and in the fauces, somewhat earlier than the eruption appears. The characteristic eruption of measles appears behind the ears and on the face with the advent of the exanthem and the temperature rises. At this time the disease is sufficiently advanced to make the diagnosis easy.

Then, too, bacteriologic examination of the nasal discharge

helps in the diagnosis. We sometimes must differentiate la grippe from whooping-cough. A baby suffering from grippal symptoms has an irritating cough; the cough is most marked when the child lies down; the baby has a stuffy, discharging nose and some fever. Whooping-cough begins with a catarrhal stage; at this time you don't know whether your patient is going to have whooping-cough or not. How may we differentiate whooping-cough from la grippe sometimes?

VISITOR: It is paroxysmal.

DR. ABT: But the paroxysmal cough does not occur until later. When the paroxysmal stage of whooping-cough makes its appearance, as late as the third week of the disease, if the physician is not seeing the child regularly, the mother or the lady next door will apprise you of the fact that the cough has become paroxysmal or that the baby is whooping. Laboratory methods may be invoked for the purpose of making the diagnosis between la grippe and whooping-cough, though it can be stated at the outset that they are far from infallible. A bacteriologic examination of the secretions from the pharynx and larynx results in some cases in the identification of a short bacillus named, after the discoverers, the Bordet-Gengou bacillus. It is sometimes difficult to grow and identify this organism even when whooping-cough is present. Some authorities ask for further proof that the bacillus is beyond doubt the pathogenic organism of whooping-cough. Alfred Friedlander and A. E. Wagner published results with the complement-deviation test for whooping-cough, and they are very sanguine that the diagnosis can be made with absolute certainty in the catarrhal stage. For the technic of this test I refer to the "American Journal of Diseases of Children," Vol. VIII, 1914, p. 136.

Besides that, the blood examination is sometimes helpful. If you find a leukocytosis of 20,000 to 30,000, with a preponderance of lymphocytes as high as 60 to 70 per cent., the diagnosis is presumptive, but not positive.

Well, then, very often when all signs fail, like in everything else in life, you must wait until the favored time before you can definitely decide. If it is la grippe, something is going to happen

to confirm the diagnosis. If, on the other hand, a true whooping-cough exists, the characteristic whoop will leave no doubt as to the nature of the disease.

Treatment.—The first thing is prophylaxis. We should try to prevent this disease as we try to prevent every disease. Of course, there are certain seasons of the year when it is rampant, when every house that contains children and adults has some persons who have grippal disorders or cold. In the home we should protect the baby from the older children; when the father or mother or nurse is ill with what they call "a cold," ordinary cold or grippal cold, they should, as far as possible, isolate themselves from the baby. Then general prophylaxis means something more: To establish a constitution in the child that will resist infection, or if infection occurs, that it will be minimal. How do we do that? By proper feeding and proper care. There is a great deal said of "hardening" the baby. We harden the baby by keeping it out of doors as much as possible, in all seasons of the year, and particularly during the warmer part of the year; by giving it daily baths, cool showers or cool sponging. It is a mistake, however, to immerse the baby in an extremely cold bath, especially if he reacts unfavorably; moderately cool sponging answers the purpose very well.

The clothing of the child is of importance. In the summer time the baby needs very little clothing; there is more danger of overdressing than underdressing. We may say that no baby should be overdressed; no baby should be swaddled in all kinds of flannels or woolens. This form of dress restricts his movements and tends to overheat him. Then, too, the baby should not be kept in too closely confined quarters. For example, in very elegant homes where there are sun-parlors and all kinds of luxuries and conveniences, the babies are frequently kept in hot rooms; such babies are hot-house babies; they are not developing resistance; you interfere with their normal development. Overheating the home and improper ventilation should be avoided.

On the other hand, we may go to the other extreme. To send a baby out of doors in the colder seasons of the year with

half-socks, with legs exposed, and with a low-neck dress, so that the front part of the chest is exposed, with insufficient clothing and insufficient protection against cold, is undoubtedly a mistake. In other words, one should display judgment about the baby's outings.

So in the home then we have the problem of preventing infection by using ordinary hygienic means of hardening the baby and keeping its health up to the highest standard.

How is it in the hospital, asylum, and public institutions where a large number of children are housed? The prevention of infection is a very difficult problem. I told you in a previous clinic that many of those who come in for alimentary disturbances are stricken with grippal infections and die. What has happened? The nurse or intern or attending man or visitor comes in with a cold, he or she coughs, and sprays the expectoration in minute quantities about the ward, or the infection is carried on the hand towels, linens, or utensils; at any rate, the infection sweeps through the place. In a ward we know that the baby should be isolated. Men have talked so intensely about this matter of ward infection that a great many of the distinguished men who treat a large number of children in wards of hospitals and asylums have contrived various schemes to prevent it. For instance, in Paris and Berlin they have erected glass partitions between the babies; they have installed the so-called "box system"—each baby is walled off by himself; each baby is separated from the other baby so as to prevent the spread of infection. Others separate the babies by placing screens between the beds. It is a good rule when a baby takes a cold to remove it from the ward to an isolation room.

So far as the methods of treatment are concerned, what shall we do with these babies?

VISITOR: Put them to bed.

DR. ABT: Strange thing about a baby, it is difficult to put a baby to bed unless it is very sick. A little baby who has already learned to sit up or creep or walk will desire to be held by mother or nurse unless prostrated by the sickness. But whether it goes to bed or not, it should be loosely clad, all tight garments

being removed, so as not to impede its respiration. The baby should be kept as quiet as possible. Toys should be taken away and overstimulation avoided. It should be given plenty of fluids, kept in a well-ventilated room of moderate temperature, and the nourishment should be continued if the patient is able to take it. The mother usually reports that, "because of the vomiting and cold from which the baby was suffering I gave him castor oil," or some other physic possibly. Next morning the physician may contribute his mite by writing a prescription for a little calomel. We don't do it here; we don't physic the baby very much; we try not to disturb the digestion; we try to keep the bowel movement as nearly normal as possible; we don't believe that we can clean the disease out of him by giving a large physic. We try to keep up the nourishment and interfere as little as possible with the intestines. We try to give him as much fluid as he can possibly take. The mother will frequently ask, "Shall I take him outdoors?" The answer is, "No." Then she starts this argument: "He is not used to sleeping indoors; he won't sleep if I don't take him out; I keep him out of doors practically all the time." Now, as a matter of fact, the sick baby needs rest and quiet; he should be in an atmosphere that is free from dust. The baby deserves the same consideration in this regard as adults do. If kept quiet in a well-ventilated room or porch with windows open and allowed to rest and recuperate he would probably be more comfortable. Personally, I believe when a baby is acutely sick, with a temperature, he is better off indoors in a well-ventilated apartment than in the street and dust, whether in summer or winter.

Next comes the medical treatment: Early in the disease the most urgent symptom is the coryza from which the infant suffers, manifested by nasal obstruction or nasal discharge, noisy and difficult breathing, and discomfort. One should not overtreat the nasal disorder. Avoid the use of irritant applications to the nostrils. Do not permit forcible syringing. A mild, non-irritating solution is the best of all—a little normal salt solution slowly instilled into the nostrils with a medicine-dropper, or boric acid solution, argyrol in 5 per cent. solution, or liquid vaselin. And,

if I may suggest, use the yellow vaselin; the white has been bleached either by chlorin or sulphuric acid, and if you taste it you will discover it is quite acid. If the condition does not clear up under the treatment just advised, adrenalin solution (1 : 5000 or 1 : 8000 diluted with normal saline solution), 3 to 5 drops, two or three times a day, may be instilled into the nose with a medicine-dropper. If the baby has a temperature and it is suffering, is crying and restless, you may order a tepid bath (95° or 98° F.). Or a tepid, moist compress may be applied, enveloping the baby's entire trunk.

For the temperature and restlessness some drugs give symptomatic relief. The use of all forms of depressant drugs should be avoided if pulmonary involvement is present or threatens. Aspirin, ½ to 1 grain, depending upon the age of the infant, two to four times a day, depending on the degree of temperature and restlessness, or pyramidon, salophen, phenacetin, antipyrin, in the same dosage, may be employed. In the recent literature one finds glowing reports concerning the efficiency of quinin, especially in the pneumococcus infections. In the German literature optochin or ethyl cuprein hydrochlorid is strongly advised, as suggested by Morgenroth. The preparation is injected hypodermically in ½- to 1-grain doses once daily. The dihydrochlorid of quinin or the bisulphate may be used in 1-grain doses in solution hypodermically. Aristoquin or euquinin (Merck) may be given in ½- to 1-grain doses three or four times a day. These preparations are selected because they are less bitter than the quinin in common use. Expectorant cough mixtures are of doubtful value even when cough and bronchitis are present. Mild sedatives are sometimes required to quiet cough and produce rest. For this purpose minute doses of codein, gr. $\frac{1}{60}$, for an infant of one year; Dover's powder, gr. ¼ to ½, for an infant of the same age, or paregoric 5 to 10 minims. Repeat in two or three hours if required.

The acute middle-ear inflammation should be treated conservatively at first, though warm phenol glycerin solution (5 or 10 per cent.) should be dropped into the ear at frequent intervals. If pain, inflammation, and bulging of the membrane indi-

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